# PLASTICS
## & MOLDED PRODUCTS

REG. U. S. PAT. OFFICE

A periodical devoted to the manufacture and use of plastic and composition products

Vol. 6 APRIL, 1930 No. 4

## Contents





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CONVEYING packaging, shipping, handling—all have a very definite reaction on the quantity as well as quality of goods manufactured. Chemicals and other industrial materials must be carefully kept in preservation during transit. In other words, when a molder receives a batch of powder it is essential that that drum, or carlot, be identical with his present run or sample. He has every right to insist, with present prices and competition as they are, that all his goods be consistently uniform and only such careful mechanical methods can give him such assurance.

To follow it a step further: system in manufacture is only one of many important steps so vital to industrial protection. A standard system of packaging or conveying need not cost an enormous sum, but a wise investment, within budget, in either of these equipments might mean a mimium of breakage and rejects with a maximum of plant efficiency. We would not, however, go so far as to recommend such investments to all molders. It is only the financially and morally progressive company who could hope to benefit.

Let us warn you that this is no new thought—and we are not "agents" for these items. In fact, we don't know who makes them. Several plants do have such methods, a large proportion of them home designed and built, that are effecting operating economy. Many more could use them, and these are the ones who should make an extensive check-up on present cost of waste hand-labor time, and similar inefficiencies.

—o—

Don't you believe it, but we have this story. A tramp stopped outside a small molding plant a few days ago and said he hadn't eaten a thing in over six days. "Bring him in", said the president, "If we can find out how he did it we can keep the plant open another week." He got the job.

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# PLASTICS

(Reg. U. S. Pat. Off.)

A periodical devoted to the manufacture and use of plastic and composition products

Vol. 6 | APRIL, 1930 | No. 4

# Calculating Dimensions of Molded Products

## Comparison of Metals and Resinoids leads to interesting conclusions

*By Dipl. Ing. M. Hirsch and Dr. H. Neubert*

RESINOID molding materials are more and more replacing the old type of electrical devices in which cast iron and porcelain parts were employed. It should be quite obvious that the different properties of the resinoid molding materials would make it necessary to resign such parts as are usually made of porcelain or cast-iron. While the construction engineer can readily to refer to the known properties of cast-iron in order to obtain data upon which to base the design of apparatus that he desires to construct, but very little similar data it available for the modern resinoid materials. Mechanical failure of molded parts, caused by improper dimensioning, are therefore by no means rare.

### Cast Iron, Porcelain and Resinoids

The present article is intended to give some information on the relative practical strength of cast iron and of porcelain as well as several of the now standardized types of resinoid plastics.

The most common stresses to which the mechanical parts of electrical and similar equipment are subject are bending stresses, not only under constant load, but under impact.

*The present article is an example of the way the matter of molding materials is being attacked scientifically and mathematically in Germany. The paper is from the Kontakt-Rommler Nachrichten, a publication of the combined Kontakt A.-G. and the H. Rommler A.-G. of Germany; being published herein by special permission of the authors and the owners of the said publication.*

The actual impact stresses that a given article is likely to encounter in service is very difficult to determine in advance. A few indications are however available through Eurapean and American testing methods for insulation. (See Elektrotechnische Zeitschrift, 1922, p. 767)

In order to obtain some practical data, two main considerations were taken, and tests made both on the constant bending stresses as well as under impact stresses of comparable nature. For purposes of comparison it was decided to test pieces having a constant width $b$, which was chosen as 4 centimeters. This plate was so supported that the distance between the supports was equal to a constant value $L$, being taken equal to 5 centimeters (See Fig. 1). The figure determined was the required thickness of the material, designated as $h$, in order to withstand in one case a constant load of 5 kilograms, and in the second case (see Fig. 2) the force exerted by the falling of a 0.5 kilograms weight from rest through a distance of 15 centimeters. The force developed was designated as $S$ and equals 7.5 centimeter-kilograms. The plate was considered as of sufficient strength when the impact of such a weight falling through the designated distance of 15 centimeters failed to break the plate.

The necessary dimensions, i. e. thickness of the plate, under the given condition, can readily be calculated by the known formula:

$$(1) \qquad P = \frac{b\,h^2}{1.51}\; k_b$$

in which the term $k_b$ is the permissible load stress per square centimeter.

Depending upon the practical use to which the article is to be put, and choosing a sufficient safety factor, the actual required dimensions of an article can thus be calculated. In the foregoing example a steady uniform

bending stress is present, so that the permissible stress in actual practice can then safely be taken as 1/3 that of the transverse bending stress. The following table gives some data on the bending strength of some well-known materials.

| Material | Strength (resistance to bending stresses, in terms of kg. per square centimeter |
|---|---|
| Cast iron | 3,600 |
| Hares C. Special, Type S | 900 |
| Resistan, Type 2 | 450 |
| Heliosit B, Type 8 | 200 |
| Hard porcelain | 600 |

(In the above table, the Hares, Resistan and Heliosit are trade names of well-known European resinoid insulating materials. The types correspond

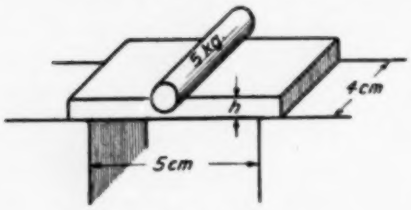


Fig. 1. Plain bending strain

to the standards of the Verein Deutscher Ingeniuere).

Based on the above values, the correspond required dimension $h$ (i. e. the necessary thickness of the plate to withstand the constant load of 5 kilograms) can be calculated as follows:—

| Material | Thickness h in millimeters |
|---|---|
| Cast iron | 0.9 |
| Hares Special C | 1.8 |
| Resistan type 2 | 2.5 |
| Hard porcelain | 2.2 |
| Heliosit B | 3.8 |

In order to determine the correct thickness required to withstand the impact exerted by a weight of 0.5 kilograms falling from rest through a distance of 15 centimeters, the impact strength data of the material must be ascertained. This is readily accomplished by the well--known type of pendulum testing machine. The test is made with rectangular rods that are supported as a predetermined supporting distance of 7 centimeters. It should be understood that whenever such a rod is struck by a moving pendulum the determined strength of the test-rod is dependent upon the area of the cross-section, namely the product of the thickness $b$ times the height $h$, whilst under constant stress the product of $b$ times $h^2$ is the determining factor. The impact strength found also varies in accordance with the distance at which the rod is supported. As the distance $L$ in the impact tests was 7 centimeters, whilst in the tests for constant strains it was only 5 centimeters, then in order to determine the impact strength for any given distance of support the factor 7/L is taken, the figure being either greater or smaller in this ratio. The impact strength of a body having a rectangular cross-section may therefor be approximately calculated when the actual impact strength of a given test-piece of the same material is known. The formula is quite empirical, but gives fairly accurate results. It is

$$(2) \qquad S = \frac{7.\ b\ h\ \sigma_s}{L}$$

This formula gives of course only an approximation. For substances having a relatively low impact strength, the influence of the variation of the distance of support is less marked.

The following table shows the actual impact strength of the materials already hereinabove enumerated, as found when testing test-pieces of the same in an impact testing-machine of the pendulum type:

| Material | Impact strength in centimeters kg-cm2 |
|---|---|
| Cast iron | 8.0 |
| Hares C. Special, type S | 7.0 |
| Resistan, type 2 | 2.2 |
| Hard porcelain | 1.7 |
| Heliosit B, type 8 | 1.7 |

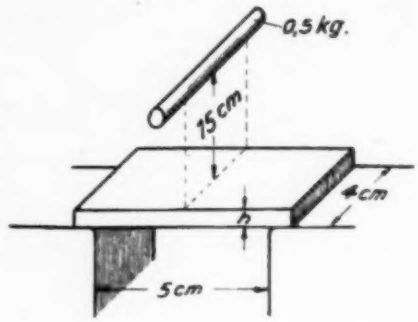


Fig. 2. Impact Test

In order to obtain a plate which will stand up when tested under the conditions illustrated in figure 2, a safety factor of 3 is chosen, which means that in the above formula the value 1/3 sigma s is interpolated. Thus is the value of S must be safely equal to 7.5 centimeter-kilograms, then, based on the other dimensions given, the formula takes the following form:—

$$h = \frac{7.5\ \ .\ 5}{7.4.\ \frac{1}{3}\ \sigma_s}$$

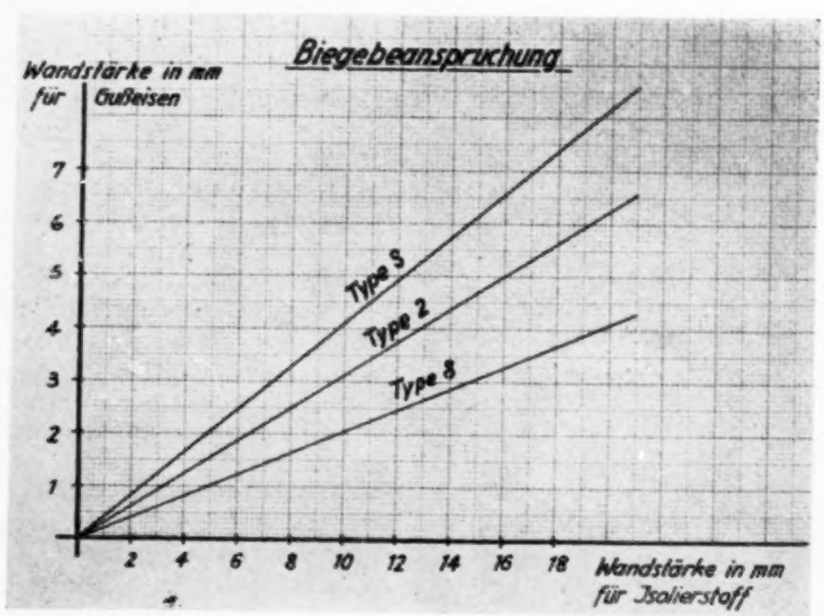


*Fig. 3. Relation of thickness of walls to bending strains. Vertical component=cast iron; horizontal=resinoids. Thickness in millimeters.*

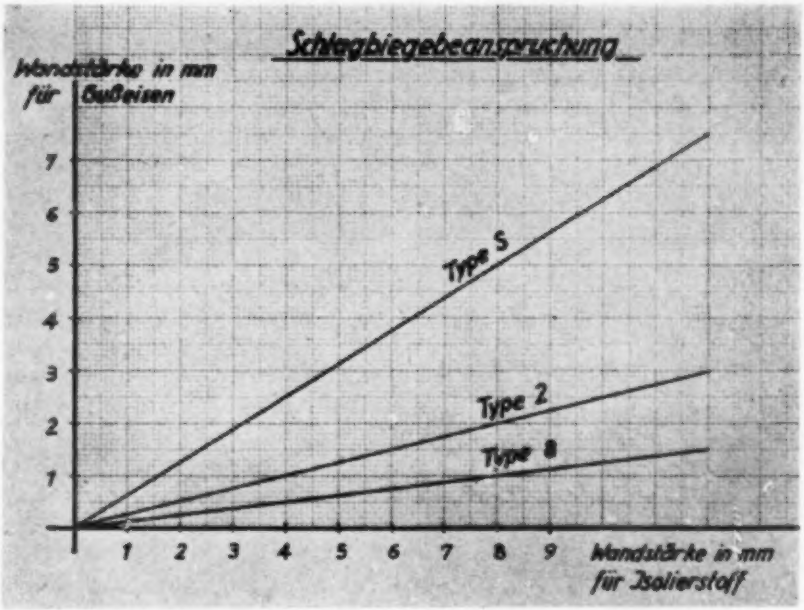


*Fig. 4. Relation of thickness to strength; impact test. Vertical=cast iron; horizontal=resinoids. Figures are in millimeters.*

Carrying out the calculations therein indicated, the following figures are arrived at:

| Material | Thickness h in millemeters |
|---|---|
| Cast iron | 5.0 |
| Hares special C. types S | 5.8 |
| Resistan type 2 | 18.3 |
| Hard porcelain | 23.7 |
| Heliosit B, type 8 | 23.7 |

The above table makes it plainly evident that when calculating the necessary thickness to withstand a given impact requires quite a different calculation then when merely the resistance to a constant bending stress must be taken into consideration.

In connection with the above tables and discussion, we shall now take up the proper dimensioning of resinoid molded materials when they are intended to replace a metal such as cast iron. The minimum allowable values as laid down by the Verein Deutscher Ingeniuere (see Elektrotechnische Zeitschrift 1928, p. 1094) for non-rubber molded insulation (in Germany) is the basis of the calculation.

| Insulation Type | Bending Strength in kilograms-sq-cm. | Impact strength in cm. kg.-cm2. |
|---|---|---|
| S | 600 | 5.0 |
| 2 | 350 | 2.0 |
| 8 | 150 | 1.0 |

a) for constant loads, using formula (1), the strength of the wall of the plate is calculated as

$$h^2 = \frac{1.5\ P\ L}{b\ k_b}$$

Therefore between the thickness $h_1$ and $h_2$ of a cast iron and of a molded resinoid plate respectively, both being of the same other dimensions, there exists the following relation:

$$h_1^2 : h_2^2 = k_{b_2} : k_{b_1}$$

which, when transposed amounts to

$$h^2 = h_1 \sqrt{k_{b_1} / k_{b_2}}$$

Employing the minimum figures given in the table, and taking the constant strain bending strength of cast iron as equivalent to 3,600 kg/cm², the graph shown in figure 3 results. The course of the cures is true not only for the resistant to bending of flat plates of the dimensions actually given but holds true for any other plate where the relation between the permissible load and the strength is equal to the product $h^2kb$.

### Relative Dimensions

In Figure 3 the horizontal component of the graph is expressed in the thickness of the molded insulating material in millimeters, and the vertical component as the necessary thickness of cast-iron, when both materials are subjected to the same bending stresses. Thus, having the dimensions of a piece of cast iron of ample strength to withstand a given strain, it is a simple matter to read off from this graph the corresponding dimensions of a piece of molded insulation of a given type.

b) For impact strength, the calculation takes its base from the empirical formula (2) already given, being therefore:

$$h = \frac{S\ L}{7\ b\ \sigma_s}$$

or

$$h_2 = h_1 . \frac{\sigma}{\sigma}$$

The thickness $h_1$ and $h^2$ of a cast iron and of an insulating molded plate of the same resistance to impact stresses are therefore related as follows:

$$h_1 : h_2 = \sigma_{s_2} : \sigma_1$$

### Calculating Dimensions

Based on these formulas and using the minimum values in the table cited, and assuming cast iron to have an impact strength of 8 cm. kg/cm², the graph shown in figure 4 is arrived at. In the graph of figure 4, the horizontal component shows the thickness of a given piece of molded insulation in terms of millimeters, while the vertical component shows the thickness of a piece of cast iron, when both pieces possess the same impact strength.

A comparison of the curves on graphs 3 and 4 show that the relationship is different in the case of impact and of constant load strengths.

In order to prevent any improper conclusions from being drawn from these curves, it must be pointed out that they are more qualitative than quantitative. The known and calculated values of impact and stress resistance of cast iron to bending stresses is also dependent considerably upon the shape of the cross-section. (See C. Bach in Zeitschrift des Ver. Deut. In-

(*Continued on page 218*)

# From An Expensive Chemical Curiosity To Commercial Production

**Starting with a practically worthless waste product, oat hulls, furfural is now produced in ton lots by comparatively simple process**

*By Carl Marx*

FOR many years furfural was almost a chemical curiosity, and available only at very high prices. Its uses were limited to a few chemical syntheses, and for the preparation of furyl derivatives. About 1917 the first furfural resins were described by Beckmann and Dehn, in Germany, and about a year later the first patent applications covering furfural resins were filed by Novotny and Romieux in America.

At that time it was not generally believed that any practical results could be expected from these inventions as furfural was then entirely too expensive to make it feasible commercially to manufacture any of the resins.

### Getting Real Results

A few years later intensive work was begun by Carl S. Miner and Harold J. Brownlee with oat hulls as the raw material for the production of furfural on a commercial basis. While it had been well known that certain types of carbohydrates such as pentosans could be hydrolyzed to form furfural, the yield when using the known processes was too low for practical production purposes. A great deal of research work had to be done to ascertain the best methods to produce the desired furfural in a plant capable of producing such quantities at a time that the material might be offered to the industry at a price that would assure a ready market.

By 1922 the work had progressed far enough to show real results. In September of that year a patent application was filed by the inventors, who were doing their work for the Quaker Oats Company at Cedar Rapids, Iowa. For seven years this application withstood the rigours of active prosecution in the Patent Office, and not until Nov. 12, 1929 did the patent finally issue as United States P. 1,735,084.

*The entire furfural resin industry would not have come into existence had not Miner and Brownlee worked out a really practical method of producing furfural on a commercial scale.*

*Their success is measured by the fact that some years ago furfural was priced at around thirty dollars a pound—now it is about ten cents!*

This delay was unavoidable, as the invention was of sufficient merit to protect it against infringement. During the time the patent was pending the actual manufacture was begun, and at the present time furfural is produced by this method in tank car lots, and sold at a price as low as 10 cents per pound, in quantity. Thousands of pounds of furfural resins are now being produced commercially, notably by the processes of Novotny and his co-workers. It should however not be forgotten that but for the perfection of this process that made furfural a commercial readily available product, the development of the furfural resin industry in America would have been impossible.

It is a noteworthy fact that in Europe the production of furfural resins is of merely academic interest, and none of them have as yet appeared on the European market.

In view of the very widespread interest shown here and abroad in the actual process of manufacturing furfural by the Miner and Brownlee process, it is believed that a short account of the disclosure in this patent will be of value in supplying information about it.

### Essential Features of the Process

Heretofore furfural has been generally produced by processes that resulted in the recovery of only a comparatively small amount of furfural. Such processes have involved immersing certain roughage materials in a strongly acid liquid and then heating this resultant liquid mixture, which comprises a substantially large water content, either with or without subjecting it to pressure, thereby ensuring a chemical reaction which results in the procurement of furfural. But furfural produced as described above is mixed with such extremely large quantities of water as to render the separation of the furfural from the reaction mixture an extremely tedious and expensive process.

Unless the furfural is removed from this reaction mixture substantially as fast as it is formed the furfural, under the conditions present, will be rapidly destroyed or decomposed and, as a result, the furfural production is considerably decreased.

By means of the present invention, it is possible to increase appreciably by the yield of furfural from roughage material and, at the same time, reduce considerably the cost of manufacture. It was discovered that

if roughage material, such as oat hulls, is merely dampened with an acid liquid and subsequently exposed to heat and pressure, a substantially high yield of furfural results which is capable of being separated in more concentrated form than in previously known processes, whereby the cost of producing this product is minimized.

### Furfural Removed as Quick as Formed

By thoroughly impregnating the reaction mixture with a continuous flow of a gas that serves as a carrier for the furfural, the furfural may be withdrawn from the reaction mixture substantially as quickly as formed. This is accomplished by injecting a multiplicity of steam jets through the body of the reaction mixture thereby thoroughly exposing the body of the mixture to the action of the steam in a fine state of subdivision and then withdrawing therefrom the steam which serves as a carrier for the furfural into a condenser. As a consequence, the furfural is volatilized and removed from the reaction chamber substantially as quickly as it is formed. By reason of this removal of the furfural very little furfural is decomposed or destroyed in the reaction chamber and this results in a very high yield of furfural.

Since roughage material that preferably has been merely dampened with an acid liquid less steam is used than is required in other processes heretofore practiced for a similar purpose. Less acid is required and a saving in acid and in neutralizing material therefore results.

If, during the exposure of the above dampened reaction mixture (i. e., one that contains no free liquid) to heat and pressure, the mixture is simultaneously agitated and exposed to a multiplicity of currents of steam passing through the digester, such currents of steam will remove at a sufficiently high rate the furfural being formed so as to minimize the destruction or decomposition of furfural which occurs when furfural is exposed for any substantial period to the reaction conditions necessary for its formation. Furfural may then be procured in large quantities, separated in higher concentrations and produced with lower consumption of steam than by the methods heretofore known and practiced.

The process is carried out in a rotary steam jacket digester or autoclave of any well known type, preferably provided with a plurality of pipes or steam inlets in order to pass a very large number of fine jets of steam through the reaction material undergoing treatment. Into such a digester there is put substantially 3000 pounds of oat hulls uniformly impregnated with a mixture of about 750 pounds of water and about 56¼ pounds of sulphuric acid (95% strength).

### Rotary Digester

The digester is then closed and rotated and if it is not sufficiently heated from a prior treatment, steam is admitted into the jacket 4 of the autoclave for such length of time as is necessary to raise the temperature of the autoclave to approximately that of steam at 60 pounds pressure. After the temperature of the mixture within the autoclave has been substantially raised, steam (in the form of a multiplicity of jets) is admitted to the cooker through the pipes and, as a consequence, the reaction mixture comprising the oat hulls becomes thoroughly admixed therewith. The steam pressure within the digester is raised to about 60 pounds per square inch. When the steam pressure within the autoclave approximates this value, the valve of the exhaust line leading to the condenser is opened sufficiently to allow steam to flow into the condenser at the rate of 1000 to 1200 pounds per hour. The autoclave is continually revolved and the steam supply is regulated so as to maintain in the digester a pressure of substantially 60 pounds. Steam is thus permitted to thoroughly mix with the oat hulls for four or five hours. After this period of time, all of the steam contained within the autoclave is blown off into the condenser and additional steam at amospheric pressure may then be passed through the oat hulls to remove the residual furfural. However, this last step is frequently not necessary.

### Advantages of Oat Hulls as a Raw Material

The steam condensed in the condenser contains about 5 to 6 percent of furfural and usually amounts to 5000 or 6000 pounds. The condensed liquid within the container is neutralized in any suitable way, preferably by adding hydrated lime or any other alkaline or neutralizing material, to ensure complete neutralization of the acid, and then is distilled to recover the furfural, which will amount to substantially more than 10% by weight of the total amount of oat hulls initially placed within the digester.

Oat hulls, as roughage material from which furfural may be procured in accordance with the process of this present invention, are highly desirable because they are resilient and do not pack within the autoclave or digester when they are dampened and when the digester is rotated during the processing of them. The mass of oat hulls is extremely porous and, consequently, permits thorough admixture therewith of the liquid which dampens the mass. Again, by reason of the porosity of the mass of oat hulls, the carrier steam or gas is permitted to penetrate the mass thoroughly, thereby bringing the carrier for the furfural, as it is produced, into intimate contact with all parts of the mass of oat hulls.

**Tentative Tests on Molded Insulation See April Issue**

# Empty Bubbles Enhance the Beauty of Pearl Sheeting

## Strikingly novel effects produced by working gas into pyroxylin plastics, and then flattening out the voids by pressure

JEAN Paisseau, who already has done considerable work on pearl effects, has worked out a new idea. He incorporates small bubbles in pearl sheeting so as to get an additional iridiscent effect.

He patented the idea, of course, and describes it very well in his U. S. P. 1,737,943, (December 3, 1929).

*The volatility of solvents is depended upon to produce the gas that clouds up the plastic mass. Fish-scales are also used to give the characteristic sheen and lustre.*

### Trapping the Bubbles

The process is based upon the fact that when employing a plastic mass containing solid particles in suspension which have preferably a flat or elongated form, such as pearl essence, small crystals or the like, if a gas bubble is formed and spreads out, and is then flattened by external pressure and re-absorption of the gas or vapour by which it was produced, the plastic mass will preserve the form of this bubble by reason of a permanent change in the distribution of the particles in the substance. This result wil be the more marked and more decorative according as the solid particles are more brilliant or reflect the light better. It may vary according as the bubbles are more or less numerous, more or less close together or united, and for like reasons.

This formation of bubbles in a systematic manner may be obtained by different methods; in the simplest method a plastic mass such as acetate of cellulose, celluloid or the like is used in which pearl essence for instance has been uniformly incorporated, and this plastic mass is submitted in a gradual manner to a temperature above the boiling point of one of the solvents contained in the mass, without exercising at the surface of the mass a pressure which would prevent the extension of the resulting bubbles.

### Volatilizing the Solvent

For example, if cellulose acetate is employed, it contains acetone as a solvent, the boiling point of the latter being 45 degrees C. By raising the temperature to 50-60 degrees or over, the acetone will be vaporized in the mass of the substance and will form bubbles which are small at first but then become larger as the adjacent bubbles come together in one, so that by a more or less extended heating and a greater or less rise in temperature, by regulating at will the size of the bubbles which are produced, according to the result which is to be obtained.

If the process deals with celluloid whose usual solvent, alcohol, boils at an excessive temperature, this solvent is replaced by one whose boiling point is lower, such as acetone, ether or the like. In this manner heating the plastic mass, when the bubbles are being formed, to a temperature at which the mass would become yellow is avoided.

It is obvious that instead of the solvent which is volatile at low temperatures, one may incorporate into the mass all suitable substances, such as carbonate of ammonia, which are adapted when decomposing to produce gases or vapours by which bubbles will be formed.

In the first place Paisseau prepares plates or sheets of plastic material which contains brilliant particles such as pearl essence, by means of any suitable process such as drawing, rolling or the like, or further, in the following manner.

If a block press of the current type is available, whose dimensions are 1.50 m. by 0.75 m. he first forms in the press, by placing in it in any suitable manner the substance containing colouring matter as it is discharged from the mixing apparatus, a block which may be for instance 30 cm. square. He then subjects the mass to heat and pressure for a few minutes, for this purpose, and the block is then removed in the hot state. It is cut into six equal parts which are 30 cm. thick, 50 cm. long and 37 cm. wide. Each part, while still hot, is placed in a block press of the same size; it is also heated and is gradually compressed until it is spread upon the whole surface of the press, whereby it will assume the form of a sheet which measures 1.50 by 0.75 m. by 5 cm. thick.

The formation of the bubbles is effected as follows.

Each of the sheets thus obtained is placed in the block

(*Continued on page 217*)

# The Resistivity of Insulating Materials

## Tentative Testing Methods as Proposed in the 1929 Revision of the American Society of Testing Materials

## Designation D 257-29T

MOLDERS and fabricators of insulating materials will be interested in keeping abreast of the efforts to formulate standards which may form the basis of specifications to which they can work, and on which orders can be taken and filled.

### Recently Revised

At the 1929 annual meeting of the American Society for Testing Materials, comprehensive methods for the testing of the restivity of insulating materials, particularly molded insulation, were proposed. These methods are tentative, but until they have been superseded by definitive tests, will be used for the actual testing of such materials when determining their specifications.

### Criticism Solicited

The tests, known as D 257-29-T, are published by request and permission of the Society, in order that they may become widely known, and that criticism and suggestions regarding them may be made; to be eventually incorporated into a set of definitive standards. For this reason all of our readers who may be interested in this subject are requested to send in their criticisms and suggestions, preferably sending them directly to the Committee responsible for working out these tests. Address the Secretary of Committee D-9 on Electrical Insulating Materials, Mr. T. S. Taylor, care of Bakelite Corporation, 230 Grove Street, Bloomfield, N. J., U. S. A.

1. These methods cover the determination of surface resistivity and volume resistivity of both solid and liquid insulating materials.

DEFINITIONS

2. (*a*) *Insulation Resistance.*—The insulation resistance between two electrodes which are fastened to or imbedded in a solid insulating material, or immersed in a liquid insulating material, is the ratio of the voltage applied to the electrodes to the total current which flows between the electrodes.

(*b*) *Volume Resistance.*—The volume resistance between two electrodes is the ratio of the electromotive force applied to the electrodes, to the current which flows through the volume of the insulating material.

(*c*) *Volume Resistivity.*—The volume resistivity is the resistance between two electrodes which cover opposite faces of a centimeter cube provided there is no surface layer or that the resistance of the surface is so high that no appreciable part of the current flows through it.

(*d*) *Surface Resistance.*—The surface resistance between two electrodes is the ratio of the electromotive force applied to the electrodes, to the current which flows through the surface layers.

(*e*) *Surface Resistivity.* — Surface resistivity is four times the resistance between two electrodes covering opposite faces of a cube when the volume resistance is so high that practically all of the current flows through the surface layers. This is equivalent to defining surface resistivity as the resistance between two opposite edges of a square of the surface layers.

Note 1.—(Applicable particularly to solids).—In the definition of Insulation Resistance, the total current may consist of two parts, that which flows through a surface layer, and that which flows through the volume of the material. The surface layer is any layer on the surface of an insulator in which the resistivity is different from that of the body of the material. The most common cause of such a layer is moisture which has been deposited on the material from the surrounding air. Insulating materials may be divided into three classes with respect to deposited moisture:

*Class 1.* Materials which are not wetted by water. In the case of such materials the deposited moisture does not spread over the surface so that there is not true surface layer. Sulfur, paraffin, and the waxes are examples of such materials.

*Class 2.* Materials which are wetted by water but which do not absorb it. In the case of these materials, the deposited moisture spreads over the surface forming a distinct surface layer. Examples of such materials are glass, quartz, amber, hard rubber, glazed porcelain, and slate. For many of these materials the resistivity of the water in the film is of the resistivity of the material. Hence, a film of water of a submicroscopic thickness which is often deposited on an insulator may conduct more current than flows through the body of the specimen.

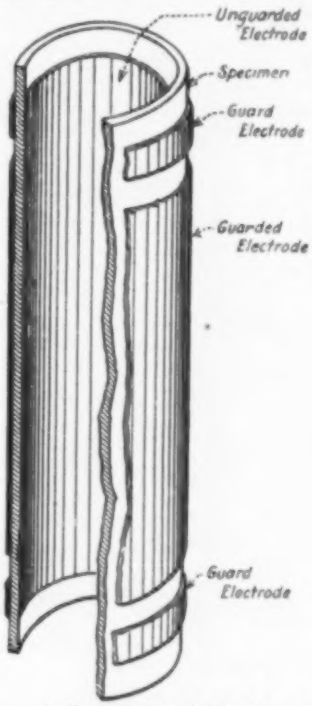


Fig. 1. Application of Electrodes to Solid Tube Specimens.

Note 2.—The definitions of Surface Resistance and Surface Resistivity are ordinarily applicable only to solid insulating materials.

*Class 3.* Materials which absorb water. With these materials, there is no true surface layer, since deposited water is absorbed into the material. If the absorption takes place slowly, there may be a gradual gradation of properties on passing from the surface to the interior. Such materials do not have a true surface layer, since the change in resistivity is continuous. Examples of these materials are wood, paper, unglazed porcelain, and many molded and laminated compounds. This class includes a large part of the commercial insulating materials.

Note 3.—In the definitions of Insulation Resistance, Volume Resistance and Surface Resistance, the resistances are defined in terms of the current which is not a constant but depends on the time that the circuit has been closed. After the circuit is closed, the current often changes quite rapidly. Theoretically, the current should not be read until it has become stationary. As this sometimes requires several hours, it is customary wherever possible to read the current one minute after closing the circuit. The resistance is usually computed from the value of the current at the end of one minute.

## Test Specimen and Type of Electrodes

*A. For Solid Insulating Materials*

3. The test specimen for solid insulating materials shall be either in the form of a flat plate or a tube.

4. The material of the electrode is unimportant so long as good contact is made between the electrode and the insulating material. For a flat plate, mercury electrodes are very satisfactory though solid metal electrodes are often more convenient, and are satisfactory provided they make good contact. With a tube, a metal spray or conducting paint may be used. Conducting paint, however, shall not be used on a porous or absorbent material.

5. *Measuring Volume and Surface Resistance.*—When both volume and surface resistance are to be measured, there shall be applied to each specimen three electrodes designated as the unguarded electrode, the guarded electrode and the guard electrode.

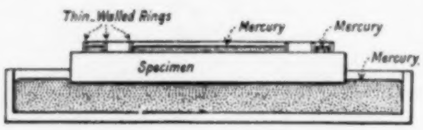


**Fig. 2. Application of Electrodes to Flat, Solid Specimens**

The method of applying these by means of a paint or spray to a tube is shown in Fig. 1. In the case of a tube specimen, the guard electrode shall be in two parts, one at either end of the tube. In the case of a flat specimen, the guard electrode shall be in the form of a ring surrounding the guarded electrode as shown in Fig. 2. In any case, the distance between the guarded electrode and the guard electrode shall be uniform and as large as 1 cm.

6. (*a*) *Measuring Volume Resistance.*—If the surface resistance is high relative to the volume resistance, the guard electrode may be omitted in measuring volume resistance.

(*b*) *Measuring Surface Resistance.*—If the volume resistance is high relative to the surface resistance, metal strips may be used as electrodes on flat plates in measuring surface resistance. One method of mounting these is shown in Fig. 3.

(*c*) *Measuring Insulation Resistance.*—Disk electrodes, as shown in Fig. 4, may often be advantageously used to measure insulation resistance where it is not necessary or not possible to separate it into volume and surface resistance. They may also be used to measure surface resistance under the same conditions as given in Paragraph (*b*).

## For Liquid Materials

*B. For Liquid Insulating Materials*

7. Samples of oil shall be obtained as described in Sections 2 to 7 of the Standard Methods of Testing Electrical Insulating Oils (A. S. T. M. Designation: D 117) of the American Society for Testing Materials.[1] Samples of other liquid dielectrics shall be obtained in a similar manner with regard to cleanliness of containers and sampling apparatus and shall be representative of the lot to be tested. The quantity of the sample depends upon the type of resistivity cell used, but in any case it shall be sufficient to permit three separate resistivity determinations.

8. Suitable electrodes for liquid insulating material are parallel planes, concentric cylinders, or coaxial cones. The distance between the electrodes shall not be less than 0.75 mm. (0.03 in.) nor more than 5 mm. (0.2 in.). The voltage gradient shall not exceed 200 volts per millimeter (5 volts per mil). The area of the electrodes shall be sufficiently large so that the current flow can be measured, with the apparatus available, to an accuracy of 5 per cent.

Note 1.—Electrode areas of 50 to 500 sq. cm. (7.7 to 77.5 sq. in.) should prove suitable.

Note 2.—Because of the catalytic action of some metals on oils, the electrodes shall be nickel, gold or platinum-plated.

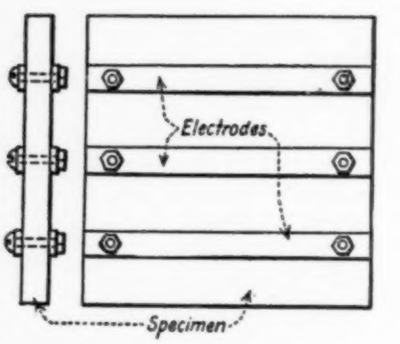


**Fig. 3. Application of Electrodes for Measuring Surface Resistance of Flat, Solid Specimens.**

## Apparatus

9. (*a*) The apparatus shall consist of a source of constant potential, a galvanometer with suitable shunts, a calibrating resistance, reversing switches and keys, and, if very high resistances are to be measured, a condenser. The apparatus shall conform to the requirements specified in Paragraphs (*b*) to (*f*):

(*b*) *Constant Potential.*—A dry or storage battery may be used as a constant source of potential.

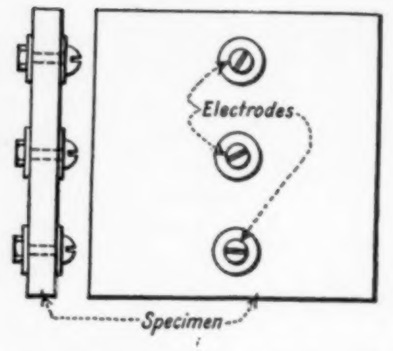


**Fig. 4. Application of Electrodes for measuring insulation resistance of Flat, Solid Specimens.**

(*c*) *Galvanometer.* — The galvanometer shall have a high-current sensitivity and will therefore have a high resistance. A sensitivity of $10^{-10}$ amperes per centimeter with scale at a meter distance is desirable. The most convenient shunt is the type known as a universal shunt whereby the current through the galvanometer may be changed by powers of ten without changing its damping.

(*d*) *Calibrating Resistance.* — The calibrating resistance shall be at least 100,000 ohms and preferably 1 megohm or more.

(*e*) *Switches and Keys.* — All switches and keys shall be mounted on high-grade insulating material. Paraffin is recommended wherever it can be used.

[1] 1927 Book of A. S. T. M. Standards, Part II, p. 796.

(*f*) *Condenser.* — The condenser shall have a high-insulation resistance and reasonably small absorption. Its capacitance shall be greater than 0.001 microfarad and preferably greater than 0.1 microfarad. A well-insulated air or mica condenser is satisfactory.

Note.—The apparatus described above will measure resistances as high as $10^{14}$ ohms. For higher resistances there must be observed special precautions such as the elimination of the conductivity of the surrounding air. A quadrant electrometer is often employed for measuring the extremely small currents which flow through a very high resistance. A method of using such an instrument is described in U. S. Bureau of Standards *Scientific Paper No. 324*, Vol. 11, p. 364.

## Measurements

10. The following measurements shall be made when both volume and surface resistance are to be determined:

(*a*) Area of the guarded electrode;

(*b*) Distance between the guarded electrode and the guard electrode;

(*c*) The insulation resistance between the guarded electrode and the unguarded electrode when the guard electrode is connected to the unguarded electrode;

(*d*) The volume resistance which is the resistance between the guarded electrode and the unguarded electrode when the guard electrode is main-

tained at the same potential as the guarded electrode;

(*e*) The temperature of the material under test;

(*f*) The relative humidity of the surroundings.

11. The following measurements shall be made when the guard electrode is not used:

(*a*) Area of the electrodes;

(*b*) Distance between or spacing of the electrodes;

(*c*) The insulation resistance between the electrodes;

(*d*) Temperature;

(*e*) Relative humidity.

Note 1.—The resistivity of all insulating materials changes considerably with temperature. It is, therefore, essential that the temperature of the specimen at the time of the measurement be recorded.

Note 2.—In the case of insulating oils it is often desirable to make measurements at an elevated temperature. For trade purposes resistivity at 85° C. or 100° C. is usually quoted.

12. In the case of laminated materials, both the surface and volume resistivities will depend on the direction of current flow. For a complete test, the volume resistance of laminated materials shall be measured both along and across laminations. Likewise, the surface resistance shall be measured between three sets of electrodes, one on a surface parallel to the laminations and two on a surface perpendicular to the laminations. The electrodes to be used on the surface parallel to the laminations may be disks, parallel strips, or concentric circles. The two sets of electrodes to be used on the surface perpendicular to the laminations shall be strips, the edges of one set being parallel to the laminations and the edges of the other set perpendicular to the laminations.

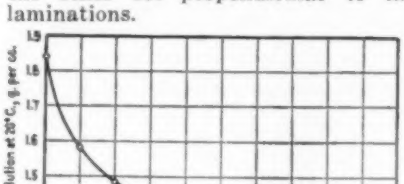


Fig. 5. Relation of Relative Humidity of Air and Density of Acid-water mixture.

## PROCEDURE

13. (*a*) Determinations of surface resistance shall be made only on specimens which have been kept for at least 48 hours in air at a definite humidity. Measurement of the insulation resistance of absorbing materials shall be made only on specimens which have been kept for 96 hours in air at a definite humidity. In either case, the specimen shall be kept undisturbed in air at this humidity during the determination. The measurements and resistivity determination shall be made without removing the specimen from the humidity chamber. For this purpose, highly insulated leads shall be passed through the walls of the chamber. This may be accomplished, even if the humidity is very high, by cutting holes in the walls at least 2 cm. (0.80 in.) in diameter, closing them with stoppers of paraffin or sulfur, and bringing the leads out through the centers of these stoppers.

(*b*) *Humidity Control.*—The humidity may be readily maintained at any desired point by using an airtight chamber in which a sulfuric acid-water mixture is exposed. The volume of the acid mixture shall be at least one-fiftieth of the volume of the chamber. The container for the mixture shall be an open vessel of such size that the area of the exposed liquid is at least three times as large as one side of a cube which woud hold the required acid mixture. The density of the surfuric acid-water mixture to give any desired humidity is shown by the curve in Fig. 5. No material which absorbs moisture, except those being tested, shall be allowed in the chamber. Provision shall be made for circulating the air and for maintaining the temperature constant. In case a lamp is placed inside the chamber, the specimens should be shielded from direct radiation. A desiccator may be used for a constant humidity chamber provided it can be kept where the temperature is constant.

14. *Methods of Measuring Resistance.*—The resistance may be measured by means of a galvanometer used as an ammeter or if the resistances are too high to be measured directly by the use of the galvanometer, a ballistic method employing an auxiliary condenser may be used to increase the range of resistance that can be measured. The galvanometer shall have a suitable shunt for increasing its range. Figure 6 shows the diagram of connections from which it will be sen that it is only necessary to throw the switches to use it for measuring either the volume resistance or the insulation resistance of specimens of the types shown in Figs. 1 and 2.

15. The volume resistance shall be determined by either the galvanometer or ballistic method, as follows:

(*a*) *Galvanometer Method.*—With the galvanometer switch at *B*, with the guard switch at *C*, with the short-circuiting switch at *E*, and with the universal shunt set at low ratio (say 1:10,000) close the reversing switch in one direction and then close the key $K_1$. Increase the ratio of the universal shunt until a readable deflection is obtained on the galvanometer. Read the galvanometer deflection one minute after closing the reversing switch. Close the short-circuiting switch to *F* and leave it in this position for two minutes. Repeat measurement with the reversing switch closed in the opposite direction. If no appreciable deflection is obtained when the universal shunt ratio is 1 to 1, the resistance is too large to be measured by the galvanometer directly.

(*b*) *Ballistic Method.*—To measure very high resistances, throw the galvanometer switch shown in Fig. 6 to

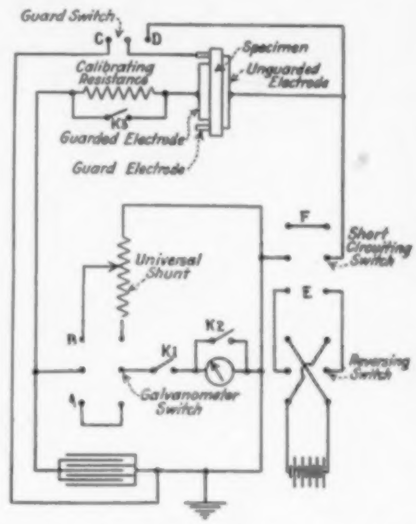


Fig. 6. Diagram of Connections for Resistivity Determinations.

*A*, thus disconnecting the universal shunt. After closing the reversing switch and the key $K_2$ (this latter to prevent the charging current which flows into the specimen from passing through the galvanometer), close the key $K_1$. Open the key $K_1$ one minute after the reversing switch is closed. Now open key $K_2$. Three minutes after opening key $K_1$, close it again, thus discharging the condenser through the galvanometer. Read the ballistic deflection of the galvanometer. After short circuiting the specimen for two minutes, repeat the measurements with the reversing switch closed in the opposite direction. If no deflection is obtained with a leakage time of three minutes, the resistance is too high to be measured by the galvanometer.

16. The insulation resistance between the guard electrode and the guarded electrode, shall be determined in accordance with the procedure for measuring volume resistance as described in Sections 14 and 15, except that the guard switch be closed at *D*.

17. (*a*) *Mounting Specimens.*—In mounting the specimens for measurement, it is important that there shall be no conduction paths between the electrodes except those through the specimen. For example, the specimens shown in Figs. 3 and 4 shall be held by one or both edges so that no one of the electrodes touches the supports.

(*b*) *Measuring High Resistances.* In measuring high resistances by the set-up shown in Fig. 6, it is important that all parts of the apparatus which are connected between the grounded sides of the battery and the guarded electrode shall be well insulated. In order to test whether the insulation is sufficient, the current through the galvanometer shall be negligible when the specimen is disconnected and the galvanometer and

(*Continued on page 219*)

# American Cellulose Acetate Plastics

## A concise epitomized review of the many compositions described in United States Patents by inventors in this field

*By Joseph Rossman*

MUCH of the work on the Cellulose acetate plastics in America was done by Lindsay, a chemist of the Celluloid Company for many years. Many of his patents are among the following.

41. Lindsay 1,188,800. June 27, 1916.

The composition of acetyl cellulose trichlorethylene, paraethyltoluolsulfonamid, triphenyl phosphate and methyl alcohol.

42. Lehmann and Stocker 1,191,-801. July 18, 1916.

Process for manufacturing celluloid like substances consisting in dissolving cellulose acetate in tetrachlorethane and in adding cumarone resin to the solution.

43. Mork and Esselen 1,193,178. Aug. 1, 1916.

A composition containing cellulose acetate, triphenyl phosphate and phenyl salicylate.

44. Lindsay 1,199,395. Sept. 26, 1916.

The process consists in adding to such acetyl cellulose a mixed solvent consisting of water, benzol and methyl alcohol; allowing the mass to stand at ordinary room temperature until gelatinization has taken place; adding to such gelatinous mass paraethyltoluolsulfonamid and triphenyl phosphate; and mixing the ingredients and subsequently applying heat and pressure.

45. Lindsay 1,199,798. Oct. 3, 1916.

A product containing an acetyl cellulose and diphenylamin obtained by dissolving it in acetone, and then permitting the solution to dry and harden by evaporation.

46. Lindsay 1,199,799. Oct. 3, 1916.

*On p. 160 of the March issue, the present article was brought up to the present portion of the review. After a brief outline of the cellulose acetate plastics, the author proceeds to enumerate the patents, giving the salient features of each one. Anyone interested in this field finds here just what he wants to know as to what has already been tried in the past—a great time-saver in p'anning research or development.*

A composition containing an acetyl cellulose, approximately 100 parts, triphenyl phosphate, approximately 10 to 40 parts, obtained by dissolving it in a common solvent, and from 5 to 30 parts of a liquid mono-hydroxy aliphatic alcohol having more than two carbon atoms.

47. Lindsay 1,199,800. Oct. 3, 1916.

The process consists in dissolving an acetone soluble acetyl cellulose, triphenyl phosphate and a high boiling liquid in a chlorinated, hydrocarbon-alcohol solvent, spreading such solution upon a surface and allowing it to dry and harden by evaporation.

48. Schmidt 1,200,886. Oct. 10, 1916.

A composition resembling celluloid containing cellulose acetate acetyl-dicyclo-hexylamin.

49. Lindsay 1,203,756. Nov. 7, 1916.

The process consists in treating acetyl cellulose with ethyl acetate in admixture with methyl alcohol and with paraethyltoluolsulfonamid and triphenylphosphate; and manipulating the mass.

50. Lindsay 1,216,581. Feb. 20, 1917.

The process of making plastic masses comprises incorporating an acetone-soluble acetyl cellulose with tetrachlorethyl acetanilid in the presence of a small proportion of ethyl alcohol and heating.

51. Lindsay 1,226,340. May 15, 1917.

The composition comprises acetyl cellulose epichlorhydrin and a monohydric alcohol having not more than two carbon atoms, paraethyltoluolsulfonamid and triphenylphosphate.

52. Lindsay 1,226,341. May 15, 1917.

The process of producing plastic compounds consists in treating acetyl cellulose with water, benzol, methyl alcohol and paraethyltoluolsulfonamid; and manipulating the mass.

53. Lindsay 1,226,342. May 15, 1917.

Plastic compounds are made from acetyl cellulose consists in mixing the acetyl cellulose with an alkylated aromatic sulfonamid and triphenylphosphate; then adding to the mixture a solvent consisting of methyl acetate and methyl alcohol, and subjecting the mass to heat and pressure.

54. Lindsay 1,226,343. May 15, 1917.

The process consists in mixing acetyl cellulose with an al-

kylated aromatic sulfonamid and triphenylphosphate; adding to this mixture epichlorhydrin and methyl alcohol.

55.Lindsay 1,229,485. June 12, 1917.

The process comprises mixing acetyl cellulose with chloroform and a monohydric alcohol having not more than two carbon atoms to produce a gelatinous mass.

56. Lindsay 1,229,486. June 12, 1917.

Plastic compounds from acetyl cellulose are made by of the variety which is freely soluble in acetone, mixing acetyl cellulose with trichlorethylene and methyl alcohol to produce a gelatinous mass.

57. Lindsay 1,229,487. June 12, 1917.

The composition comprises acetyl cellulose, an aryl acetamid, chloroform, and a monohydric alcohol having not more than two carbon atoms.

58. Dreyfus 1,242,783. Oct. 9, 1917.

Cellulose acetate in a solvent comprising alcohol trichlorethylene.

59. Lindsay 1,244,107. Oct. 23, 1917.

The process comprises incorporating about 100 parts of an acetone-soluble acetyl cellulose with about 20 to 50 parts of an aryl sulfonamid, about 40 to 100 parts of a monohydric alcohol having not more than two carbon atoms, and further incorporating therewith about 1 to 4 parts of a mixture consisting of about 70 parts by volume of alcohol and about 30 parts by volume of chloroform.

60. Lindsay 1,244,347. Oct. 23, 1917.

The process of making plastic masses comprises incorporating an acetone-soluble acetyl cellulose with an aryl sulfonamid in the presence of a small proportion of a monohydric alcohol having not more than two carbon atoms.

61. Lindsay 1,244,348. Oct. 23, 1917.

The process of making plastic masses comprises incorporating about 100 parts of an acetone-soluble acetyl cellulose with about 20 to 50 parts of an alkyl acetanilid having not more than two carbon atoms in the alkyl group.

62. Lindsay 1,244,349. Oct. 23, 1917.

Solvents for an acetyl cellulose consisting of a mixture of a monohydric alcohol having not more than two carbon atoms, the mixture further comprises from 10 to 40 percent of chloroform, and an aryl sulfonamid.

63. Lindsay 1,245,476. Nov. 6, 1917.

A composition containing a cellulose acetate and triphenylphosphate obtained by dissolving them in chloroform, and dichlorohydrin.

64. Lindsay 1,265,217. May 7, 1918.

The process consists in dissolving an acetyl cellulose plastic in chloroform and camphor in a common solvent, adding a liquid monohydroxy alcohol having more than two carbon atoms, and drying.

(*Continued on page 216*)

# Plasticized Hard Rubber in Submarine Cables

EXTRUSION of plasticized hard rubber composition about a continuous cable, rather than resorting to the application of the rubber followed by vulcanization, is an interesting example of modern development in the application of plastic materials on a large scale for industrial purposes. While the method is described in connection with a particular form of hard rubber that has been sufficiently plasticized to permit extrusion, there is sufficient interest in the method adopted to act as an incentive to the working out of similar problems with other plastic materials.

### Continuous Extrusion

The invention, as far as the plastic features of it are concerned, comprises the continuous extrusion of a plastic material about an advancing core of cable, properly covered with the necessary magnetically permable alloy and other insulating materials. The inventor, Robert R. Williams, of Roselle, N. J. describes it as follows in his patent U. S. L. 689,312; Oct. 30, 1928, assigned to the Western Electric Company:—

To provide an insulated conductor having the desired characteristics, the invention contemplates the use of an insulating compound which is first vulcanized then rendered plastic and extruded in a continuous sheath about the conductor by means of heat and pressure.

### Bitumen Added

In practicing this invention, sheets of vulcanized hard rubber are rendered plastic by working them in standard rubber mills, the rolls of which are heated, or in some other equivalent manner. The term "hard rubber" is here used to also include these compositions sometimes referred to as "semi-hard rubber" in which the sulphur component may be as low as 15 per cent. In order that the vulcanized sheets may be more easily rendered sufficiently plastic to permit the material being extruded, it is desirable to include in the rubber compound a thermoplastic material such as a bitumen, preferably of one of the harder varieties. While the composition of the insulating compound will obviously depend largely upon the temperatures and pressures employed, a compound, which may be extruded at a temperature of 150° C. or somewhat less and with extruding pressure of from 1000 to 2000 pounds per square inch consists of approximately 60% rubber, 20% sulphur, and responding to 90 to 100 pounds steam pressure until the free sulphur content is reduced to .5 per cent or less in a manner such as is now commonly employed in the hard rubber industry.

# Sound Records and the Resinoid Plastics

**First artificial resin phonograph record was made only seventeen years ago. Shellac still reigns supreme, but many synthetic resins have been proposed, and may yet displace this natural resin**

*By Charles W. Rivise*

IN the March issue (p. 157) a continuation of the disclosures in the American patent art on synthetic resinoid sound records was promised. Here it is.

12. M. J. Callahan, 1,108,330, Aug. 25, 1914, Filed Feb. 8, 1913.

This is the first U. S. Patent suggesting the making of phonograph records from an artificial resinoid other than a condensation product containing formaldehyde. The composition is made by slowly heating to about 185° C. a mixture consisting by weight of about two parts of phthalic anhydride and one part of glycerol, until distillation ceases. Heating is then continued at about 210° C. until small samples when cold are hard and brittle without stickiness. The product may be molded with heat and pressure to form an infusible record tablet or may be rapidly heated until bubbling occurs to form a porous mass, comminuted, molded under mechanical pressure to form the record blank and finally heated.

13. J. W. Aylsworth, 1,146,299, July 13, 1915, Filed July 22, 1913.

A fusible phenolic resin such as phenol resin made by condensing phenol or cresol with formaldehyde is brought into solution by means of an alkali or alkaline oxide or hydroxide. A filler such as wood flour, asbestos fiber, or cotton flocks is thoroughly intermixed therewith and the base neutralized by heating in air or by the addition of an acid. Neutralization causes the condensation product and salt to be precipitated about and within the filler. In case the base is an alkali, the acid may be stearic or palmitic, or an acid resin such as contained in colophony or common resin may be used. In case of an alkaline base, sulphuric, oxalic or carbonic acid may be used, the latter preferably in form of a gas. A hardening product such as hexa is incorporated and the product molded to infusible form. The formed blank is then coated with a fusible phenol resin that may be hardened after the impression is made.

*While here in America the phonograph has just about disappeared, except in little portable models, there is an increasing use of electrical pickup devices for use with radio sets. This keeps up the demand for records. "Talkies" also make great demands on record molders. Future development is uncertain as "light-recorded" sound film is a keen competitor—but still "plastics" are a pre-requisite in all sound reproduction.*

14. J. W. Aylsworth, 1,146,387, July 13, 1915, Filed Feb. 3, 1910.

The record comprises a flexible disk formed of an elastic yielding backing and an elastic flexible non-stretching record surface. The backing is preferably a thin sheet of softened paper or fabric, the interstices of which are filled with linseed oil, rubber or celluloid, the latter being softened by means of castor oil or a halogenized fatty acid such as chlorinated stearic acid. The record surface may be formed of a film of cellulose ester such as celluloid, cellulose acetate and structureless cellulose, casein film and condensation products of phenol and formaldehyde or other methylene containing substance. The surface may be formed directly on the backing or may be preformed and cemented to the backing. The condensation product may contain a solid solvent or plasticity agent. The record is flexible enough to be rolled for shipment and must be used on a machine wherein the permanent table serves as a backing for the record. Such a machine is disclosed in Patent 1,062,579.

### Aylsworth Introduced Plasticizers

15. J. W. Aylsworth, 1,146,389, July 13, 1915, Filed Sept. 15, 1910.

The method consists in introducing fluid record material into a plurality of axially alined disk molds, repadily rotating the molds about their common axis, applying heat to the periphery of the molds so that the hardening proceeds from the periphery of the disk toward the center and then removing the disks. Each record mold consists of two complementary interlocking elements one or both of which have record mold surfaces on their inner faces. The record material is forced into the molds through an opening in the shaft about which they rotate.

*(Continued on page 216)*

# Technical Abstract Section

## A Concise Review of Patents and Literature

**Rosin—Phthalic Acid—Glycerol resin.** Andre Henri Victor Durr, assignor to Compagnie Nationale de Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies, Etablissements Kuhlmann, of Paris, France. U. S. P. 1,739,446; Dec. 10, 1929.

At 110°, 285 parts of phthalic anhydride and 200 parts of colophony (acid value=162.5) are added to 240 parts of glycerine.

The temperature is raised to 260 in 15–20 hours and the running off is effected after having maintained the temperature at 260° for 2 hours.

The resin obtained has a Ubbelohde dropping point at about 105°–120°.

At 110° 285 parts of phthalic anhydride and 100 parts of colophony (acid value=162.5) are added to 220 parts of glycerine, the temperature raised to 260° in 8 hours and the mass run off at this temperature.

The Ubbelohde dropping point of the product is 106°–112°. The products are excellent for adherent lacquers.

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**Resinous Condensation Product for Oils Phthalic Acid and Glycerol.** Andre Henri Victor Durr, assignor to Compagnie Nationale de Matieres Colorantes et Manufacturers de Produits Chimiques du Nord Reunies, Etablissements Kuhlmann, Paris, France. U. S. P. 1,739,447; Dec. 10, 1929.

**Example I**

450 parts of linseed oil and 450 parts of resin prepared by combining a polyhydric alcohol, a polybasic acidic substance and a natural resin at high temperatures are placed in a well stirred autoclave. The mass is heated for 16 hours at 210°. The pressure rises to 5 or 6 kilos.

The mass is then left to cool at 50° –60° and tests made to ascertain if it be completely homogeneous. If it does not happen to be so, it is heated again for 8 hours at 250° and longer if neccessary.

The mass is in a viscous form at the ordinary temperature, of a greenish yellow colour, slightly fluorescent.

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**Resinous Condensation Product of Phthalate Resin Type.** Andre Henri Durr, assignor to Compagnie Nationale de Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies, Establissements Kuhlmann, Paris, France. U. S. P. 1,739,448; Dec. 10, 1929.

A finely pulverized mixture of one-half glyceryl phthalate resin, Ubbelohde dropping point 142–151°) and one-half resinic ester prepared from colophony is fused at 110-120°.

The temperature is progressively raised. From 200° upwards, an abundant gaseous emission is observed. The temperature is raised up to 290° in 8 hours, and the mass is poured when the temperature indicated has been reached. The product obtained is entirely soluble in the organic esters as well as in their mixtures with alcohol and hydro-carbons.

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**Phenol-Aldehyde Condensation Products.** Michael Melamid, of Berlin-Zehlendorf, Germany. U. S. P. 1,-727,076; Sept. 3, 1929.

100 grams phenol are heated on the water bath to about 40° and then a mixture of 60 grams formaldehyde of 30%, and 300 to 400 grams 10% sulphuric acid are added. The reaction is finished in about two hours. After the excess of phenol and the water have been driven off, a resin is obtained with a melting point of about 90° C. This product is not changed upon being remelted and does not become insoluble.

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**Producing Phenolic Condensation Products.** Oscar A. Cherry and Franz Kurath, assignors to Economy Fuse and Manufacturing Company, of Chicago, Ill. U. S. P. 1,726,650; Sept. 3, 1929.

The process which consists in producing a mixture of a reactive methylene containing substance, phenol, furfural and a substance which will liberate ammonia, said reactive methylene containing substance being present in sufficient quantity so that an infusible product would result upon heating and then heat treating said mixture.

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**Liquid Coating Composition Containing Synthetic Resin.** Gerald H. Mains, assignor to Westinghouse Electric & Manufacturing Company. U. S. P. 1,730,857; Oct. 8, 1929.

A liquid coating composition comprising a condensation product resulting from the reaction of formaldehyde, a drying oil and a coal tar acid containing a substantial amount of xylenol.

The process of preparing a liquid coating composition which comprises heating a mixture of formaldehyde, a drying oil and a coal tar acid containing a substantial proportion of xylenol.

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**Phenol-benzaldehyde Resin.** Emil E. Novotny and Charles J. Romieux, assignors to John Stogdell Stokes, of Huntingdon Valley P. O., Pa. U. S. P. 1,738,310; Dec. 3, 1929.

A mixture of 100 parts of anhydrous phenol and 100 parts of technical bensaldehyde is placed in a suitable vessel connected to a fractionating column so constructed that no phenol and only relatively small amounts of benzaldehyde are passed into the distillate. The mixture is boiled for about two hours with the still head maintained at 200 to 215° F. and the temperature of the mixture rising gradually from 350°F. to 480° F. A hard, brittle, slightly reddish, transparent, fusible resin is thus obtained. Other examples are also given.

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**Phonograph Record.** John E. Guernsey, Indianapolis, Indiana. U. S. P. 1,728,932; Sept. 24, 1929.

A sound record provided with a record groove and an auxiliary spiral groove continuing beyond the inner end of the record groove and so formed as to cause the tone arm of a reproducer to be moved toward the center of the disc, then away from the center of the disc a distance greater than the initial movement toward the center of the disc.

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**Cellulose Acetate and Shellac Sound Record.** Leo Rutstein, assignor to Celanese Corporation of America. U. S. P. 1,727,039; Sept. 3, 1929.

A composition for phonograph records comprising 100 pounds rotton stone, 100 pounds finely ground record mass, 75 pounds china clay, 40 pounds mica, 5 pounds lamp black, 10 pounds cotton flock, 10 pounds orange shellac, and 80 pounds of plastifier composed of cellulose acetate to which a nonvolatile solvent of the same has been added in suitable proportions.

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**Method of Forming Disk Phonograph Records.** Annesley De Los Smith, assignor to Cameo Record Corporation, New York, N. Y. U. S. P. 1,737,619; Dec. 3, 1929.

The method of forming disk phonograph records consisting in compressing a mass of molding material between dies having edges which substantially meet to form the periphery of the record and are serrated to give the edge of the record between its two faces indentations, the points formed by the serrations in one die cooperating with similar points formed on the other die, and forming in the extruded web successively weakened points of attachment between it and the record proper.

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**Synthetic Resin Varnish.** Gustave E. Landt and William H. Adams, Jr., assignors to Continental Diamond Fibre Company of Newark, Del. U. S. P. 1,731,071; Oct. 8, 1929.

A process for preparing a synthetic resin varnish which comprises reacting ammonia and formaldehyde in an organic solvent in which it will react to form hexamethylenetetramine, and thereafter dissolving the initial condensation product of a synthetic resin.

**Synthetic Resin Varnish.** Gustave E. Landt and William H. Adams, Jr., assignors to Continental-Diamond Fibre Company, of Newark, Del. U. S. P. 1,731,072; Oct. 8, 1929.

A process for preparing a synthetic resin varnish which comprises dissolving the initial condensation product of a synthetic resin in an organic solvent, and thereafter reacting in said solution ammonia and formaldehyde to form hexamethylenetetramine whereby a potentially reactive varnish is obtained.

**Laminated Product.** Harry Parker Mills, assignor to Bakelite Corporation. U. S. P. 1,730,586; Oct. 8, 1929.

Asbestos forms the upper surface of a composite sheet of layers of paper impregnated with phenol resins, this yielding a non-carbonizing surface.

**Phenolic Condensation Products.** Oscar A. Cherry, of Chicago, assignor to Economy Fuse and Manufacturing Company, of Chicago, Ill. U. S. P. 1,737,917; Dec. 3, 1929.

The method of preparing a material suitable for casting which consists in heat treating a phenolic body and an active methylene containing substance in the presence of formic acid, the amount of formic acid being in substantial excess of the amount present when commercial formaldehyde is employed to supply the methylene groups.

The composition of matter produced by heat treating a phenolic body and an active methylene containing substance in the presence of formic acid, the amount of formic acid being in substantial excess of the amount present when commercial formaldehyde is employed to supply the methylene groups.

**Phenolic Condensation Products.** Oscar A. Cherry and Franz Kurath assignors to Economy Fuse and Manufacturing Company, of Chicago, Ill. U. S. P. 1,737,916; Dec. 3, 1919.

The process which consists of heating a phenolic substance and a reactive methylene containing substance in the presence of furfuramide.

A potentially reactive product comprising a substance containing reactive methylene groups, furfuramide, and the resultant of the chemical reaction of substantially equal parts by weight of a phenolic substance and formaldehyde which reaction has been permitted to continue until separation into two layers has occurred, which reaction has been stopped when slight thickening has occurred.

**Decolorizing Film.** Edmund B. Middleton, of Parlin, N. J., assignor to E. I. Du Pont De Nemours & Co., of Wilmington, Del. U. S. P. 1,743,155; Jan. 14, 1930.

The process of decolorizing dyed cellulosic films which comprises treating the films with a bleaching agent to bleach the dye and soaking the bleached product in a liquid which is solvent for the bleached dye but is not a solvent for the cellulosic material, the liquid having decolorizing carbon suspended therein.

**Press Construction.** Louis W. Hottel, of Detroit, Mich. U. S. P. 1,748,176; Feb. 25, 1930.

In a molding press, a bed member having a mold receiving cavity, a shiftable wedge forming one side of the cavity, a mold case assembly including mold plates and adapted to fit in said cavity, a rod engaging said mold case, and a fluid actuated member having means for moving said wedge and connected to said rod of the mold case for raising and lowering the same.

A mold press for molding hollow articles comprising in combination, a bed having a mold receiving cavity, a movable wedge element forming one side of the cavity, a mold case assembly adapted to enter said cavity, a die cooperating with the mold case, and means for simultaneously moving said slidable wedge element and the mold case assembly and effecting a part of the movement of the wedge before the die is pulled from the mold case whereby locking pressure may be relieved from the wedge.

**Process of Uniting Parts of Artificial Resin.** Johann Karl Wirth, of Berlin-Altglienicke, Germany. U. S. P. 1,747,964; Feb. 18, 1930.

A method of connecting artificial resin plates or other artificial resin parts with one another or with parts of other materials for the purpose of forming containers, vessels or other hollow bodies, apparatus or parts of the same, consisting in providing the edges or surfaces to be connected with slots, recesses or indentations or other analogous forms, effecting the homogeneous connection or jointing with unhardened artificial resin masses, and hardening these masses.

A hollow body made of hardened artificial resin under conditions in which excessive shrinkage of the walls of said body occur in the process of hardening the same, comprising a wall of artificial resin having the connected edges thereof formed so as to adapt them to interlock, and a layer of artificial resin in the joint between said interlocking edges homogeneously welded to said edge to unite them.

**Pearl-Sheeting Covered Cloth.** Paul Ganzinotti, Union City, N. J. U. S. P. 1,743,447; January 14, 1930.

Inasmuch as pearl essence when applied to cloth and other fabrics does not reproduce the desired mottled and striated effects, this inventor first forms a sheet of the pearl material, by applying a suspension of fish-scale "pearl essence" in the usual pyroxylin lacquer to a smooth film-wheel or its equivalent and strips the film and cements it to cloth or paper. A film a half of a thousandth of an inch thick will do. The side of the film next to the wheel is the smoother, and therefore preferably forms the outside of the finished article. The film is attached to the cloth by the usual pyroxylin cements.



## Sound Records

(*Continued from page 213*)

The record material is a phenolic condensation product. If desired the ingredients necessary to form the condensation product, such as phenol and formaldehyde or their partial reaction products may be forced into the molds. A phenol resin in fused or liquid condition together with hexamethylenetetramine or tri-oxymethylene may be used with or without inert fillers and plasticity agents such as mono-nitronaphthalene. A reinforcing web or substance may be placed within the molds and the record material forced thereabout or a metallic peripheral ring may be placed in the mold to form an outer encasing ring about the completed record.

**See May for continuation**

## Acetate Plastics

(*Continued from page 212*)

65. Levey 1,295,533. Feb. 25, 1919.

A plastic composition comprising cellulose acetates, cellulose nitrates, and paritally oxadized and polymerized China wood oil.

66. Kessler 1,303,563. May 13, 1919.

A composition containing cellulose acetate, acetaldol and a volatile solvent mixture comprising acetone, ethyl acetate, benzol and denatured alcohol.

67. Clarke 1,309,980. July 15, 1919.

A composition of matter comprising cellulose acetate 10 parts, acetone 40 to 100 parts, dibutyl oxalate 1 to 10 parts.

68. Dreyfus 1,315,480. Sept. 9, 1919.

Cellulose acetate is subjected to a pressure of not less than about 300 kilograms per square centimeter.

69. Levey 1,316,311. Sept. 16, 1919.

A plastic composition comprising more than 50% of hydrated

cellulose acetate and less than 50% of cellulose nitrate carrying in solution therein castor oil.

70. Dupont 1,317,276. Sept. 30, 1919.

Plastic composition derived from acetate of cellulose to which a mixture of alcohols, ortho and paraoxy-benzylic has been added.

(*Continued in May*)

## Bubbles

(*Continued from page 204*)

press, and it is protected on each side by a metallic plate which is heated to the proper temperature for the formation of the bubbles, i. e. above the boiling point of the solvent. This operation is performed without pressure, so as not to prevent the formation of the bubbles, and herein the press serves as a heating apparatus. After the bubbles have been formed, the press will be gradually cooled to a temperature below the boiling point of the solvent, and pressure is applied at the same time in order to compress the sheet and to flatten the bubbles.

In this manner there is obtained a certain number of sheets in which the bubbles are formed, and the sheets are then superposed in a block press of the same size and are made into a single block by heat and pressure which are maintained for several hours, according to the usual practice. After cooling, the block is removed and is cut into sheets of the proper thickness.

### A Modification

Instead of forming the bubbles in a successive manner in the different parts of the block, a simplified process in which a block is first formed with the superposed sheets is used and when the block is thus constituted, the bubbles are produced in the mass by a gradual heating of the press to a temperature above the boiling point of the solvent, the piston of the press being lowered. In this

case the heating will be continued long enough to allow the central part of the mass to be heated to the proper temperature. The heating must be carried out in a gradual and progressive manner, so as to avoid all over-heating of the outer parts. Several other modifications are also described.

## Dimensioning

(*Continued from page 201*)

gen. 1888, p. 192, 221, 1089; and 1889, p. 137; also C. Bach and R. Baumann in "Elastizitat und Festigkeit", 1924). A merely mechanical application of the data on the graphs is therefore not indicated. The matter is also somewhat complicated by the known fact that when using insulation to replace cast iron parts that the shapes chosen usually differ quite markedly.

It may also be mentioned that in the construction of parts where insulation replaces metal, the newer types of highly fibrous molded material are being employed, such as the material known in Germany as Harex (Made by the H. Römmler Akt.-Ges). This material has a bending strength as high as 1800 kg/cm$^2$, so that comparatively thin-walled pieces can be molded therefrom. The use of mechanical metallic inserts also makes it possible in many cases to get along with thinner walls than the calculation would indicate.

In future articles by the authors of the present one some actual calculations and experiences in the production of molded parts will be taken up.

In May Plastics

A Review of the Japanese Pyroxylin Plastic Industry in 1929

By R. Sekido

Editor, "The Nippon Celluloid Jiho"

## Resistivity Tests

(*Continued from page 207*)

attached apparatus is maintained at a potential above ground, which is as high as that of this part of the circuit when the measurements of the resistance are being made. For this test, it is generally sufficient to replace the battery by a source of electromotive force having about one one-hundredth of the voltage of the battery. The ground shall then be changed to the opposite side of the battery so that it is connected to the lead going to the unguarded electrode. The circuit shall be opened at the guarded electrode. With the key $K_1$ closed the current through the galvanometer shall be less than 5 per cent of the current which flows through the specimen during measurement.

(*c*) *Measuring Volume Resistance.*—In measuring the volume resistance, it is important that there shall be no current flow between the guarded electrode and the guard electrode. This requires that the guarded electrode and the guard electrode shall at all times be at so nearly the same potential that the current flow between them is negligible. The exactness at which these electrodes shall be kept at the same potential will depend on the resistance betwen them as compared with the resistance of the specimen. In order to test this, the key $K_3$ shall be arranged to short circuit the calibrating resistance which is connected to the guarded electrode. With the direct deflection method, the galvanometer reading shall be the same with this key open and closed, unless the resistance of the specimen is of the same order of magnitude as the calibrating resistance.

(*d*) *High Humidity Atmosphere.*—With specimens in a high humidity atmosphere, the electrolytic action of the film of moisture at the metallic edges of the guard electrode and guarded electrode may produce an electromotive force. This will tend to send a current through the galvanometer. To test for this, it is only necessary to close the key $K_1$ with the galvanometer switch at $B$ and the battery switch open. If the electromotive force is of importance, there will be a deflection of the galvanometer with the shunt set at the ratio used in making the measurement. No satisfactory readings can be made if this electromotive force gives an appreciable current. The only remedy is to use new electrodes.

### CALCULATIONS

18. If the calibrating resistance has a sufficiently high value, the resistance of a specimen, which may be measured by direct deflection, may be easily compared with the calibrating resistance. When measuring the specimen, call the shunt ratio $s$, and the galvanometer deflection $d$. Then open the guard switch and connect the guarded electrode to the unguarded electrode, thus short-circuiting the specimen. With the key $K_1$ closed, read the galvanometer deflec-

tion $D$ and the shunt ratio $S$. Then, if the calibrating resistance has a value $M$, the volume resistance $R$, may be calculated from the formula:

$$R = M \cdot \frac{D}{d} \cdot \frac{S}{s}$$

If the calibrating resistance is so small that the battery used in the measurements will give too large a deflection of the galvanometer with the smallest shunt ratio, then it is necessary to calibrate by means of a low-voltage battery. The same measurements shall be made as in the previous case, but now it is necessary to know the voltage of the calibrating battery, $E$, and of the measuring battery, $e$. Then:

$$R = M \cdot \frac{D}{d} \cdot \frac{S}{s} \cdot \frac{e}{E}$$

When using the leakage method, the current, $i$, through the specimen is so nearly uniform during the time that the key $K_1$ is open, that the average value may be taken. Then $i = q/t$, where $q$ is the quantity that collects on the condenser in time $t$. When discharged through the galvanometer, this quantity gives a ballistic deflection $d$. Hence, if the electromotive force of the battery is $e$:

$$R = \frac{e}{i} = \frac{et}{q} = \frac{et}{kd}$$

where $k$ is the ballistic contant of the galvanometer. To determine $k$, a known quantity, $Q$, is discharged through the galvanometer. To obtain $Q$, a condenser of capacitance $C$ is charged with a cell of voltage $E$. Then $Q = CE$. This quantity is discharged through the galvanometer giving a deflection $D$. It follows that:

$$k = \frac{Q}{D} = \frac{CE}{D}$$

This value of $k$ may then be used in the above formula to determine $R$.

19. The volume resistivity, $\rho$, shall be calculated from the formula:

$$\rho = \frac{RA}{l},$$

where

$R$ = the volume resistance;
$A$ = the area of the guarded electrode; and
$l$ = average thickness of the specimen.

Theoretically, certain corrections should be made to this formula. For instance, for specimens in the form of tubes, the exact solution would consider that the lines of flow are the radii of circles. This results in a logarithmic formula for the resistivity. However, by suitable expansion, the above formula gives the first approximation which is sufficient for this work. Also, this formula assumes that the lines of flow are straight from the edge of the guarded electrode to the unguarded electrode. This is not the case but the edge correction is negligible.

20. *Surface Resistance.*—The surface resistance is the resistance between any two electrodes in either Fig. 3 or Fig. 4, provided the volume resistance is so high that practically all the current flows through the surface film. If the insulation and volume resistance have been measured by means of either of the specimens showns in Fig. 1 or Fig. 2, then the surface resistance may be calculated from the formula:

$$\frac{1}{R'} = \frac{1}{R_s} - \frac{1}{R} \quad \text{or} \quad R' = \frac{R_s R}{R - R_s}$$

where

$R'$ = *the surface resistance*

$R_s$ = *the insulation resistances*

$R$ = *the volume resistance*

Unless $R$ is at least 10 per cent greater than $R_s$, the value of $R'$ shall be considered infinite, indicating no surface layer.

21. (*a*) The surface resistivity, σ, shall be calculated from the surface resistance and the size and position of the electrodes, from the following formula:

$$\sigma = \frac{R'b}{l}$$

where

(*b*) In case the electrodes are concentric circles on the same side, as in the case of the flat specimen, as shown in Fig. 2, the length $b$ is the mean of the circumference of the guarded electrode and of the inner edge of the guard electrode.

(*c*) In the case of the cylindrical specimen shown in Fig. 1, $l$ is the average distance between the guarded electrode and each of the guard electrodes, while $b$ is twice the circumference of the cylinder.

(*d*) If the electrodes are strips on a flat sheet, as shown in Fig. 3, $l$ is the distance between the strips and $b$ their length. In this case, however, $b$ shall be at least ten times $l$ in order that the correction for the end of the electrodes will be so small that it may be neglected.

(*e*) In case the electrodes are disks of equal size as shown in Fig. 4, the surface resistivity may be calculated from the formula:

$$\sigma = \frac{\pi R'}{\log_e \left[ \frac{d}{2r} + \sqrt{\left(\frac{d}{2r}\right)^2 - 1} \right]}$$

where

$d$ = the distance between the centers of the disks;

$r$ = the radius of the disks.

If $d$ has a value between $3r$ and $4r$, then the following approximate formula may be used:

$$\sigma = \frac{\pi}{2} \cdot \frac{R'(d + r)}{d - r}$$

REPORT

22. The report shall include the following:

(*a*) The volume resistivity in ohm-cm. units;

(*b*) The surface resistivity (when determined) in ohms;

(*c*) The temperature in degrees Centigrade;

(*d*) The percentage relative humidity.

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| **Sutermeister, E.**—Casein and its Industrial Applications | 1927 | 296 | 5.00 |
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| Special leather bound, published @ ........ $7.50 | | | |
| **Weiser**—Colloid Symposium | 1928 | 1300 | 5.00 |
| **Wilson, S. P.**—Pyroxylin Enamels and Lacquers | 1927 | 253 | 3.50 |

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# *BOOK DEPARTMENT*

**Plastics—114 East 32d St., NEW YORK**

# MOLDED PRODUCTS

(Reg. U. S. Pat. Off.)

Devoted to the purchase, further use and merchandising of all manner of molded parts

Vol. 4 APRIL, 1930 No. 4


# Two Hundred Million Salesmen For One Thousand Dollars

## A means of telling the world about molded articles


*By Benn C. Budd*

*Director of Marketing*

*O. S. Tyson & Co., Inc.*


"WHY don't you get down to brass tacks?" said one executive of a plastic material manufacturer, referring to the marketing article in March **"Plastics"**. "We've discussed co-operation for some time. Now we want to get away from glittering generalities and call Old Man Specific into conference".

All right, Mr. W. L. F., your suggestion is seconded. You want facts—here they are. First—a realization of the advantages of molded parts of articles by one population will result in easier acceptance and greater demand for their articles. Back of every manufacturer is his public. Giving them what they know about and want is his job.

To-day some manufacturers are mentioning in their national advertising that their product "has a molded case" or that it is "molded of so-and-so material." Needless to say these references are in mighty small type. And as far as sales advantage is concerned they might just as well be left out, because the readers of these advertisements have never been told of the many advantages of molded articles from their viewpoint.

Would Chevrolet use "Body by Fisher" as a big sales points if no one knew who Fisher was? Why does Timken advertise to the masses while his sales are confined to manufacturers?

### Co-operative Effort

It is now an accepted fact that mass education and advertising result in greater sales. And what will work for paint—flowers — pineapples — photographs and so on through a list of over eighty industries, will work for molded products as a group.

So far, so good, but there are four big questions still to be answered. **First** — To whom should the advertising be directed? **Second**—What should we say? **Third**—What would it cost? And **Fourth**—Who would pay for this cost?

First:—There are four distinct groups to be sold—consumers, retailers, manufacturers and the plastic industry. All these should be thoroughly reached.

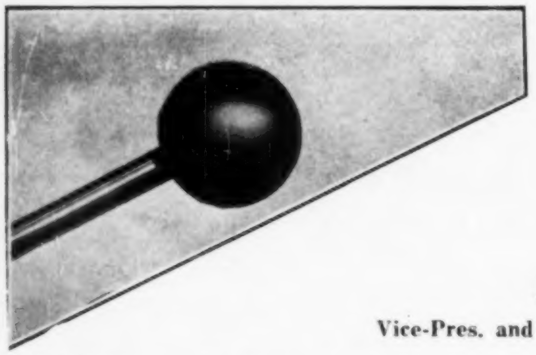
### Awakening All Interests

Second: — The consumer should be told and sold the advantages of molded articles or parts. The retailer likewise should be shown the greater saleability of molded articles or parts. The manufacturer should be informed of the growing demand for molded articles or parts. And the whole plastic industry should be instructed in the ways and means of capitalizing this effort.

Different materials and applications would receive their share of publicity in proportion to certain fixed factors to be mutually agreed upon.

Third:—The cost of such a campaign would be approximately one million dollars a year. This would enable a thorough coverage of the four groups—consumer—retailer — manufacturer and the molding industry. Over two hundred million speci-


(*Continued on page 237*)



# Phenolic Resinoids In the Automotive Industries*

*By Dr. L. V. Redman*
Vice-Pres. and Director of Research, Bakelite Corp.

I DRIVE a car which I have long felt is the best car on the road. So do you, and it does not matter much what car you drive. Any of them is so much better than we have any right to expect a piece of machinery to be that we cannot help feeling that ours must represent an exception to the run of cars.

This trouble-free service, so characteristic of the present-day automobile, represents an engineering achievement of the first order, but it is by no means a mechanical achievement only. Materials of construction superior to anything known before the advent of the automobile have made this marvelous mechanism possible—alloy steels that make lightness compatible with strength and even defy that age-old enemy, rust; rubber, unique among modern materials that outdoes its own miraculous service of yesterday and lives to see it completed; glass that is hard and clear but unsplintered by force of impact; protective coatings that laugh at Nature's slow hardening processes; synthetic organic plastics that outrival anything heretofore produced by Nature or by man in the character of their enduring service — these achievements of modern chemistry have made possible that miracle of engineering, the modern automobile.

*Presented at the Detroit Regional Meeting, American Society for Testing Materials.

### Electrical Applications

Previous to 1910 the electrical equipment of the great majority of automotive vehicles consisted of a magneto, or a battery ignition system with secondary coil, interrupter, and a series of dry cells, or, on some of the more expensive cars, a combination of both.

The illuminant of the headlights was acetylene, that of the tail light was oil, and such things as stop lights, cigar

Dr. L. V. Redman

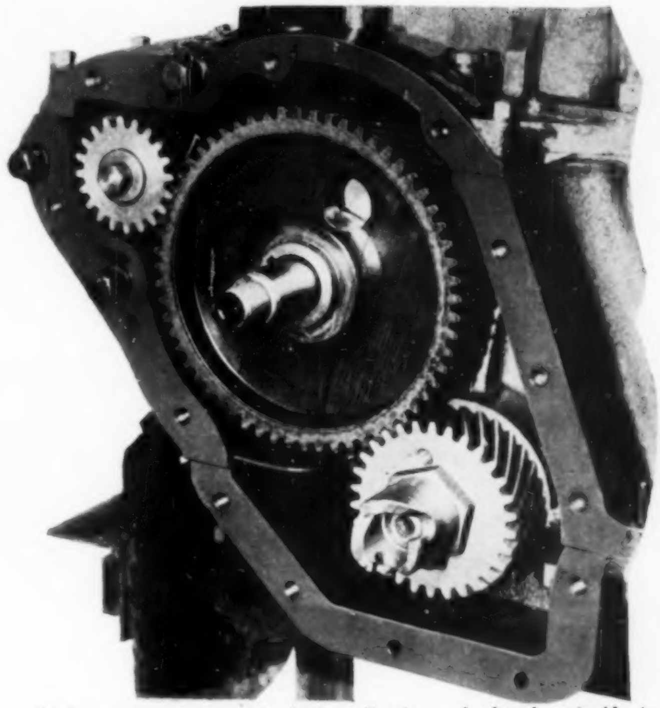
lighters, electric horns, clocks and other electric devices with which the present-day automobile is equipped, were entirely unknown. In spite of the small amount of electric equipment employed, 90 per cent of the roadside troubles, aside from tire trouble, could be traced to the ignition system. In those days, an experienced driver, when his car ceased to function, would immediately begin checking over his ignition system, unless some other unit was obviously at fault.

### Shellac, Paraffin and Wax

Of the failures traceable to the ignition system, a large proportion was the result of defective insulation, which at that time consisted of rubber or shellac molding compounds for the timers or distributors; fiber for the switch bases and coil housings; and paraffin, beeswax, and rosin for the saturating and sealing compounds employed in the coils.

It should be noted that all of these materials, with the exception of fiber, soften with heat,


New molding materials, of high electrical resistivity and high dielectric strength, have been developed to serve the increasing demand for high standard performance in the ignition systems of airplanes and automobiles.



Chief among purely mechanical applications of phenol resinoids in the automobile, is that of the camshaft gear of canvas laminated resinoid, used to silence the operation of the timing train.

some at relatively low temperatures, while fiber has the serious defect of high moisture absorption with decided dimensional variation.

In the old one-cylinder and two-cylinder cars the ignition apparatus could be and usually was located remotely from the motor to avoid heating the insulating materials, but in spite of this on warm days the fusible sealing compound would run out of the coils; the rubber timers and shellac distributors would distort and the contacts in time become loose; while in rainy weather the fiber would short, and where it was used as a base for the vibrating points, the adjustment of these would change with the weather.

The situation was bad enough, but with the development of multi-cylinder cars, which necessitated locating the ignition device under the hood and closer to the motor, these troubles were intensified.

### Ignition and Resinoids

It so happened that about the time Kettering was developing his starting, lighting, and ignition system, Baekeland was developing just the type of materials needed for the insulation of this system. These new materials, the phenol resinoids, trademarked by their inventor "Bakelite", were promptly adopted for the insulation of the new automotive electric equipment and proved to be the solution of its insulation troubles. As a result we find in present automotive electric equipment, distributors whose electrical properties are not seriously affected by coatings of oil, dust, mud or water that may be thrown off from the engine or drawn through the radiator; we find rotors which are held to very close manufacturing tolerances, which they maintain under the highest operating temperatures. We find coils impregnated with a phenol resinoid, sealed with a strong non-fusible phenol resinoid cement, and the whole assembly sealed in a phenol resinoid coil housing so well protected that even after weeks of submergence in water they will, when removed, still function perfectly. We find switch backs incorporating as many as twenty inserts with a definite spacing between them that is not affected by the temperatures encountered under the hood or cowl even in the hottest days.

Furthermore the accuracy with which these parts may be molded and the low cost of securely embedding metallic inserts at time of molding, admirably adapt the phenol resinoid molding materials to mass production of replacable parts, which is the foundation of our modern economical production of the automobile.

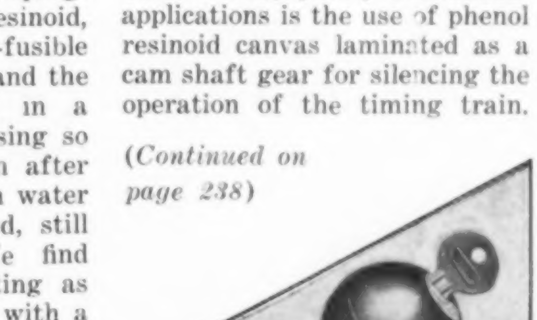
As soon as the present type of electric equipment had demonstrated that it provided an ample source of electric energy, about the first accessory in which a change was suggested was the headlights; so the acetylene lamps with their troublesome generators that occasionally blew up and their gas tanks, which had a way of running out of gas when most needed, were replaced by simple electric bulb headlights. But no sooner had cars thus equipped been placed on the road than the bulbs began to shake out of their bases.

The new phenol resinoid materials again furnished a solution of the difficulty, this time with a special cement which had been developed for the high candle power, nitrogen-filled lamps. Today all lamps used in automotive equipment are based with a phenol resinoid cement.

### Mechanical Applications

Not only in the electric system have phenol resinoids found application, but in other parts of the car they are doing service of one kind or another. Chief among purely mechanical applications is the use of phenol resinoid canvas laminated as a cam shaft gear for silencing the operation of the timing train.

(*Continued on page 238*)



# British Industries Fair Shows Progress In Plastic Fields

## Resinoids, Casein and Cellulose Ester Products All Show new and varied Applications

**By *A. C. Blackall***

*British Correspondent*

ALL attendance records were broken at the British Industries Fair this year. More than 200,000 people visited the London section and about 165,000 saw the Birmingham Fair. The orders placed run into many millions. Each of the sections of the Fair had its own characteristics and many activities not represented in London were displayed at Birmingham. Displays of plastic products and molded materials, however, were generously spread over both sections. For the whole ten days of its run the great trade exposition was thronged with interested people. The turnstiles show that 154,800 buyers attended the London section, against 114,700 last year, while 51,000 of the general public visited the stands, compared with 32,000 in 1929. Some 1,100 more foreign buyers saw the London show this year than last, the total number being nearly 5,000. One buyer in thirty came from abroad. There were visitors not only from every leading country in Europe and from America, but from every British Dominion and Colony, and from places as unexpected as Iraq and Iceland, Guatemala, and Syria.

**Many New Products**

The outstanding tribute to the Fair's interest, however, was the huge attendance of the general public. The non-commercial visitor could take away nothing tangible, yet he was thoroughly fascinated with the novelties to be seen (over 3,000 new products were introduced to the world via the Fair) and it will be surprising if their demand through retailers is not indirectly effective in stimulating trade in many directions. Business done at the Fair compares very favorably with business done last year.

This year's Fair happily assumed more of the character of an exposition and less that of a fair such as the interminable White City buildings lent it in the past. All stands other than those of a special design were constructed with fascias of uniform depth and columns of uniform height and each section had a distinctive color scheme. The Fair was unquestionably a more brilliant spectacle than ever before. Within a few minutes of its opening a Birmingham exhibitor at Olympia received an order for £40,000 ($200,000). Pictorial display


Not only are the numerous articles at the stand of British Celanese, Ltd., made of Cellastine or Celastoid, but all the fittings are made of these materials as well.

Her Majesty Queen Mary, accompanied by Princess Mary, purchases molded boudoir articles of "Nevalyte" at the stand of Myers, Ltd., at the British Industries Fair.

was effectively utilized by the majority of exhibitors, and there were "pocket" movie machines at work everywhere demonstrating a variety of industrial processes.

### Forty Molders Exhibit

The exhibits of chemicals and allied products were well located in the middle of the Empire Hall and included 12 exhibitors of casein and casein products, eight celluloid and vulcanite exhibitors, and some 40 manufacturers exhibiting molded products or materials of interest to the molded goods trade. The largest stand was that of Imperial Chemical Industries, Ltd., which consisted of a motion picture theater surrounded in exterior by alcoves in which were exhibited the various products of the undertakings associated in this combine. A painting on each alcove symbolized the particular activity of the company represented. The worldwide expansion of the combine, whose capital approaches $500,000,000, could be visualized by a revolving glass globe showing the connections throughout civilization. At one end of the stand were numerous packages in the condition in which they leave the factories and works. The merging of the four main companies in the combine is now so complete that for all practical purposes the original concerns have lost their identity. The combine owns 119 factories and employs approximately 49,000 workers, while it has over 500 depots for handling its products in Britain. Among the most interesting exhibits were a number of cellulose lacquers and other cellulose preparations. The firm has been carrying out a research program with regard to cellulose products and claims for its lacquers qualities hitherto unattained.

### Cellulose Acetate Plastics

Another extremely interesting and artistic display was that of British Celanese, Ltd., the great rayon firm, which had its stand decorated with an array of very beautiful lacquered panels. Cellastine and Celastoid were the main products featured. The latter is a non-brittle, hard yet flexible and resilient plastic solid which can be drilled, tapped, threaded, stamped, turned, molded or blanked. It has a high deep plate finish which can be retained in working, thereby reducing finishing costs. Unpolished Celastoid needs no sand-papering or scraping, a polishing mop bringing up the mirror-like surface. It is claimed not to splinter. It has been tested in the thickness of 5/1000" by the British Electric & Allied Industries Research Association and has been proved to have valuable electrical properties. The permitivity was determined at 100 when in a normal condition as regards moisture content and temperature, the value obtained being 6.4, which is similar to mica. It was shown in sheets and tubes. Cellastine was shown in sheets, rods and molding powders. It is a cellulose acetate compound containing a plastifying agent which under the most vigorous tests and climates has proved perfectly



Of particular interest at the Bakelite Ltd. stand was the new white molding material which is finding wide application in bathroom fittings. Bakelite also exhibited at the Birmingham Fair.

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At the Beetle Products stand, a new picnic basket, fitted with molded cups and saucers, cutlery with colored handles, salt and pepper cellars, and molded vacuum flasks, were favorably greeted by visitors.

stable. Its inherent qualities of insulation, stability and hardness are combined with a resiliency and elasticity which make it the most workable of plastics.

This firm's latest production is a new flexible glass made on a foundation of openwork or reticulated material enclosed in a coating of synthetic resin and cellulose acetate (or other organic derivative of cellulose), and where the foundation consists of iron or steel netting, the coating of synthetic resin affords a complete protection against the action of the weather. If desired any suitable dyes, pigments, etc., may be added to the coating composition to produce beautiful color effects, and these may be added either in the preliminary coating or the final dipping solution.

**Bakelite Shows White Material**

The exhibit of Bakelite, Ltd., was of a very comprehensive nature, the products featured comprising laminated panels with wood-grain finishes, a new white molding material shown for the first time, cements, lacquers, and electrical fittings. The white material mentioned should be particularly suitable for bathroom fittings. The firm also exhibited at Birmingham.

The stand of Myers (London), Ltd., was honored with a visit from Queen Mary, who purchased a manicure set, powder bowl, and tray in green casein ware. Princess Mary purchased a clock from the same firm molded in imitation green shagreen. The imitation was so realistic as to defy the eyes of all but experts. The firm specializes in toilet articles, combs, garment hangers, candlesticks, and smokers' novelties.

**Beetle Stand Draws Crowds**

Two stands were jointly occupied by the British Cyanides Co. and the Beetle Products Co., manufacturers of synthetic resins and molding powders. Some beautiful effects in bathroom tiling were novelties of this display, while much interest was displayed in some new picnic baskets completely fitted out with molded cups, saucers, plates, knife handles, pepper and salt cellars, and vacuum flasks. At the rear of the stand a molding press was in operation producing sample discs in a wide range of colors, illustrating to potential buyers the complete molding process.

Another firm molding Beetle powders and exhibiting at Olympia was Brooks & Adams, Ltd., Birmingham, who showed examples of 16 beautiful translucent shades of tableware. This ware is both light and unbreakable and is now finding a wide market.

Before building the Empire Hall, Olympia's exhibiting area, excluding gangways, amounted to 190,000 square feet. By the addition of two floors of the new Empire Hall this is increased by 30 per cent and when the other two floors are completed in 1931 the stand space alone will exceed 300,000 square feet. So that the Fair might be held permanently at Olympia hereafter, it was necessary practically to double the space, but the site available was not much more than one-fourth of the area covered by the existing structure. A departure from the customary practice of holding the Fair on one floor had, therefore, to be made, and remarkable ingenuity was used to overcome official and public prejudice against a multi-floor exposition and to make all the floors equally attractive.

**Pyroxylin Toys Shown**

Toys, games and fancy goods of all kinds were featured on the three stands occupied by Cascalloid, Ltd., Leicester, who also specialize in advertising novelties. In this field they make up special articles to the requirements of other trades. The countless uses of pyroxylin plastic were seen to good effect on these stands.

One of the most interesting displays in the whole Fair was that of the London Association for the Blind, which showed the bewildering variety of articles

(*Continued on page 238*)

## Ownership Statement

Statement of ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912 of Plastics published monthly at Washington, N. J., for April 1, 1930.

State of New Jersey, County of Warren ss.: Before me, a Notary Public in and for the State and county aforesaid, personally **appeared R. C. Gilmore, Jr., who, having been** duly sworn according to law, deposes and says **that he is the Business Manager of the Plastics Magazine and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:**

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

**Publisher, Plastics Publications Inc., 114 E. 32nd Street, New York City; editor, Carl Marx, 114 E. 32nd Street, New York City; managing editor, R. C. Gilmore, Jr., 114 E. 32nd Street, New York City; business manager, R. C. Gilmore, Jr., 114 E. 32nd Street,** New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member must be given.) **Plastics Publications Inc.; R. C. Gilmore, Jr., 114 E. 32nd Street, New York City; R. C. Gilmore,** Sr., 114 E. 32nd Street, New York City; Carl Marx, 114 E. 32nd Street, New York City; A. K. Gilmore, 114 E. 32nd Street, New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding one per cent of total amount of bonds, mortgages, or other securities are: (If there are **none, so state.) Sylvan Hoffman, 114 E. 32nd Street, New York City.**

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

**5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ...................... (This information is required from daily publications only).**

R. C. GILMORE, JR.
Business Manager.

Sworn to and subscribed before me this 25th day of March, 1930.

(SEAL) FRANK E. ROBERTSON.

My commission expires July 3, 1930.

**Form 3526—Ed. 1924.**

# Casein and Resinoid Plastics Adorn The Modern Woman

THE modern woman uses many materials to adorn herself. Throughout the ages, her female ancestors have availed themselves of many materials of natural origin with which to enhance their innate beauty. Silken fabrics and precious metals have been used since time immemorial to adorn woman's glory. Jewels have been dug out of the earth for this same purpose. Only within the last generation, however, have the natural resources of the earth failed to fully accomplish the demands placed upon them in this regard.

Within the past generation, the chemist has supplemented the work of nature in beautiful-

ly garbing woman. There is no need here to go into the extent that rayon has brought finery of silken nature to so many people. The rayon chemist's colleague—the synthetic plastic specialist—has brought gem-like materials to millions of people who could never enjoy nature's true gems.

By using various base substances, the chemist has brought plastic materials simulating almost every gem into common every day use. These are available for decorative uses on women's garments and accessories which, if they were real gems, would be worth an emperor's fortune.

The first plastic material used for this purpose was pyroxylin. Tortoise-shell combs were made to an extent far beyond that possible with the greatest annual tortoise-shell crop that was ever known. With the advent of the boyish, and other, bobs, combs were soon discarded as an article of adornment.

In time, the newer plastic materials were called upon to go further in simulating nature's treasures. Casein solids, phenolic resinoids and latterly amino-resinoids have added to the store of possibilities, each because of some characteristic of its own. The casein solids became available in light, warm colors which were capable of a high and lasting luster. The phenolic resinoids are perfect imitations of amber, which nature provides only in limited quantities, and can also be made in clear, brilliant greens and reds. Latterly the amino-resinoids have been developed, so that now milady may employ a clear, crystal-like material to accentuate her loveliness.

In the two panels shown on this page are a variety of hat and dress ornaments made by Supreme Jewelry Novelty Company of New York City, in which most of the materials described herein have been employed. During this season, the amino-resinoid 'Prystal' has found much favor. This is a material imported from France, and which is not yet made in commercial quantities in this country. In many instances the clear 'Prystal' has been inlaid with black and green casein solids. Catalin, in its translu-

cent colorings and unique mottlings has been extensively employed. A pale amber Bakelite is used in the large dress buckle that is fastened with the heavy pin. In such wise has chemical synthesis helped make woman beautiful.

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**Addendum**

The caption under the Coty Manicure Tray in the March issue of Plastics and Molded Products was incomplete in that the name of the material used in production, Durez, was not mentioned.

The Editor.

# Molded Printing Plates After Four Centuries of Wood and Metal

**Flexo Plates, pressed out of synthetic plastic composition, promise to replace electrotypes for printing illustrations**

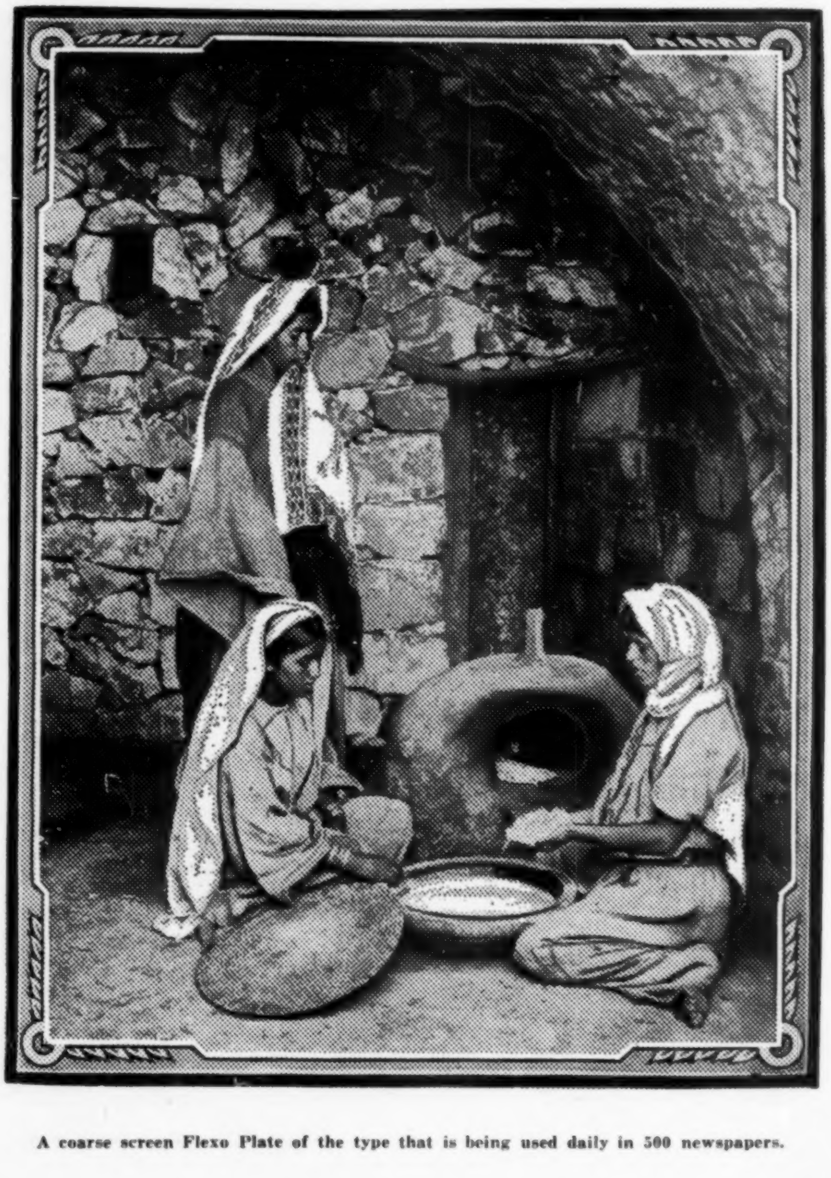
DEVELOPMENTS in the plastic industries often find reverberations in other industries that have gone on for decades before plastics, either synthetic or natural, were known or utilized. In the case of printing, illustrations have been reproduced on paper from some form of wood or metal plate for centuries. Whatever refinements have been accomplished in the technique of graphic reproductions, still wood or metal have always been involved. In the present instance, however, the printing craft has successfully employed a new type of plate, in which neither wood nor metal are utilized for the printing surface, but rather a synthetic plastic composition which is capable of infinitely speedier production than the best time in casting metal plates, has but one-seventh the weight of the metal plate of the same dimensions, and is capable of every operation that the metal plate undergoes in the printing process.

### Composition Flexo Plate

Flexo Plates, as these plates are called, are being made by Herbert Enterprises, Inc., in New York City. In effect, they are paper impregnated with a plastic composition which makes it possible to mold the finished plate in a metal die in a hydraulic press in the very short time of twenty seconds. This plate is then ready to be made up in a form on a flat bed press. mounted type-high, and used for printing beside hand-set or machine cast type, just like any metal half-tone, line-cut, or electrotype.

Modern printing, however, is more complicated than this simple arrangement. In a modern newspaper plant, where hundreds of thousands of copies are printed for each edition, rotary presses are used. Even the rotary presses will benefit and some of the daily papers have already tried out these plates in their work. Ordinarily, in making up a form for a rotary press which is to be used for printing newspapers, the mat for illustrations is first cast, the casting is then set up with text matter which has been linotyped, and a new mat is made of the whole, from which in turn the final castings are made. When the Flexo printing plate is used, this can be set directly into the form from which the final mat is made without any preliminary casting so that the mat is made directly from the form.

Flexo Plates have a rather definite place in the scheme of things related to printing. They cannot do everything. Their specific function is to replace the electrotype. Electrotypes, any number of them, are made



A coarse screen Flexo Plate of the type that is being used daily in 500 newspapers.

This illustration, printed in September, 1929 issue of Plastics and Molded Products from a copper half tone, is reprinted from a Flexo Plate made from the metal engraving.

when reproductions of an illustration, of which a half-tone photo-engraving was first made, must appear simultaneously in a number of publications at various printing plants. The electrotype is deposited in a mold made from the original halftone, a process consuming some hours. In the production of Flexo Plates, the halftone must be made in the same manner as for the production of electrotypes, but the halftone is used as the master from which a steel die is made. This die is then placed in a hydraulic press which turns out finished plates in a twenty second cycle.

### Inventor Long Interested in Plastic Materials

The plates were developed by a man long interested in plastic developments and still interested in the manufacture of the Flexo Plate. Fred C. Goldenbaum, a manufacturer of combs, dabbled in graphophone records. Then for a time in experimental work, he worked with a more prosaic medium—namely, poker chips—on which he attempted to produce certain designs. What could be so attractive as a poker chip with, let us say, the likeness of the host of the evening impressed upon it? Then he conceived the idea of producing a flexible printing plate. Without going into details as to his failures, which were numerous enough, we come to the result. The result is undoubtedly almost as important to the small newspaper as the invention of movable type itself by Guttenberg nearly 500 years ago.

### Plates are Resilient

These patent flexible plates are so resilient that they can be bent into a complete circle without developing a crack; their surface is so tough that they can be stepped upon without causing any scratches. They are so lasting that they will make six to seven times as many clear impressions as an electrotype and they are so cheap that the smallest newspaper can afford to buy them generously and burn them up when they have been used.

Flexo Plates are rather past the stage of preliminary development. For eighteen months a plant at Rutherford, N. J., has had a production of 150,000 square inches weekly. Mr. Edward J. Herbert states that 500 newspapers are supplied with a syndicate photo service which uses Flexo Plates exclusively. 1300 newspapers have thoroughly tested the plates, have found them satisfactory in every aspect and have approved them for durability in printing. With over 22,000 newspapers in the United States alone, it may be seen that this is an application of a molded plastic that has tremendous possibilities.

The extent of its possibilities has been held in check, like so many other new developments, by the temporary lack of facilities. Present equipment cannot meet any greater demands than are filled at the moment. There is, however, a new Flexo Plate plant being constructed at North Bergen, N. J., which will at once have twenty times the capacity of the present plant, in other words, it will be able to produce 3,000,000 square inches of plates weekly.

### Advertisers Will Use Them

Newspapers are only one outlet for plates of this type. Mr. Herbert has stated that advertising agencies are keen to use these plates for their national advertising clients. The plates have advantages other than those of interest to the printer. These revolve mainly about the comparatively slight weight of Flexo Plates. One of the larger electrotypers has a daily postage charge of $6,000. The electrotyper does not stand this cost but passes it on to his customer, eventually the advertiser. Flexo Plates, having a weight of one-seventh of the metal plate, would cut this charge to the advertiser way down, because postage charges are determined on the basis of weight. Further, the flexibility of the plates makes it unnecessary to pack them as carefully as in the case of the metal plate. The thinner form of Flexo Plate may be slipped into an envelope with no more protection than a piece of cardboard behind it. Corrugated board around the heavier plate gives it ample protection. There is no need of packing the plate in sawdust as is so often done with metal plates.

The cost of the Flexo Plate is its most attractive feature. They can be manufactured to

(*Continued on page 236*)

# New Mammoth Sheeter for Safety Glass Pyroxylin

SINCE the introduction of safety glass, there has been a growing demand for the product in larger size than has been possible with present day equipment. The limiting feature to date has been the size of the transparent sheet of pyroxylin which is cemented between the two sheets of glass. This size has been arbitrarily standardized by practise, at 23"x56", leaving the only possibility for larger safety glass with this stock, in the use of more than one sheet of pyroxylin, with the unavoidable and unsightly seam in the finished product.

### Larger Sizes Needed

Convinced by the demand, of a field for a larger product, the largest company manufacturing pyroxylin is adding the necessary equipment for producing sheet stock in the unprecedented size of 41x67 inches. With performance specifications most rigid and exact, and details of construction left entirely to the builder, the Burroughs Company of Newark, N. J., undertook the design and construction of the sheeting machine required for this work. Having originated and built sheeters over a period of sixty years, this company preferred the hydraulic machine originated by them to the mechanical screw type, as did also the buyers.

The substantial sheeter bed of the machine is of box-section construction, and furnishes support for the seamless-steel, bronze-lined cylinder. A differential piston, or ram, provides for cutting on the push stroke, rather than pulling the knife through the stock as is sometimes done. The table is furnished with the usual T-slots to allow for bolting down the block of stock, and in addition, extra slots are provided permitting the bolting down of two standard size blocks, in case of such requirement. An easily adjusted gib-strip insures proper alignment of the table, while ample lubrication of the ways and generous bearing surface makes adjustment seldom necessary.

Heavy side stanchions furnish a vertical and rigid support for the cross-rail which carries the knife. A tie piece between these stanchions at the top, furnishes a convenient location for the motor used in raising and lowering the cross-rail without feed. A clutch which must be held in operation by hand, demands the attention of the operator, and precludes the probability of overstroking the cross-rail in either direction, with consequent damage. A simple mechanical reversing gear has been used to eliminate an undesirable reversing motor.

### Simple Mechanism

A very simple ratchet and pawl feed mechanism allows of adjustment to 0.001" in sheeting stock from 0.005" to 0.200". While this feed may be operated manually when so desired, in automatic operation it is controlled by a lever and dog device, depending upon the position of the table, and operates through the medium of compressed air. Two vertical screws actuate the cross-rail, through bevel gears, while during the cutting stroke, the cross-rail is securely locked in position on the stanchions by a compressed air locking cylinder acting through double levers. The cutting knife is rigidly bolted to the crossrail and is given a lead of 1" at one end.

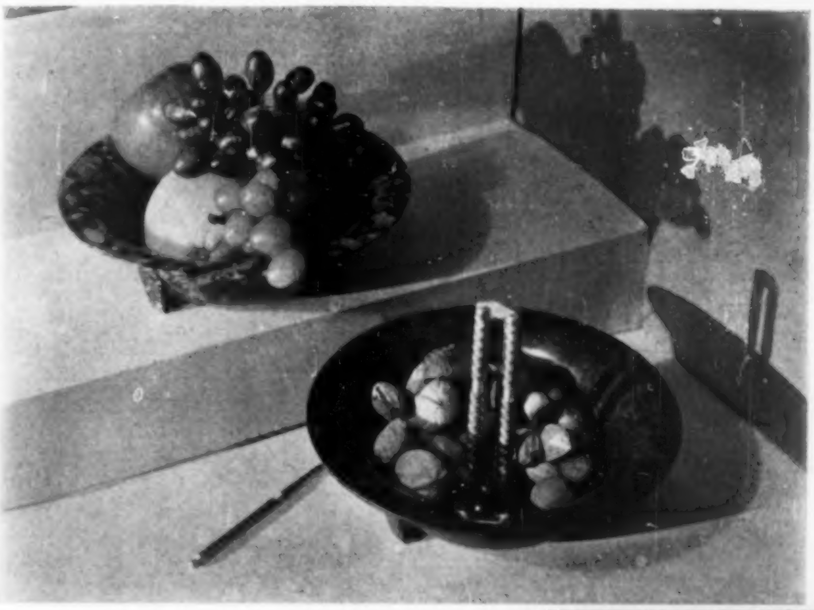
The finished machine, in spite of its size and the exacting specifications adhered to, is simple in design. It offers the utmost in convenience of operation, dependability, and performance, and represents the largest sheeting machine ever built for this work.

## Everhot Waf-fil Baker Uses Molded Handle

THE Swartzbaugh Manufacturing Company have completely modernized the old time Waffle Iron. Their new "Everhot Waf-fil Baker" turns out, on a production basis, finger shaped waffles. The "Everhot Baker" is not confined to the fast waffle eaters' capacity but may be used for making eclairs, patty shells, cake waffles, etc.

The Swartzbaugh people selected Norton Laboratories of Lockport, New York to mold the very attractive handles, Black Durez being used for the first or support section and 2211 green durez flaked with White for the handle or knob proper, a rich and most pleasing effect. The Norton Laboratories have put more than molding into this little job and proved again the old saying that while perfection is a trifle, trifles in turn make perfection.

# New Molded Products for the Home, Office and Industry



The Bakelite molded pin dispenser, aptly entitled "Tak-A-Pin," is convenient addition to any office desk. No more pricked fingers or fumbling for loose pins with "Tak-A-Pin" at hand, for a slight downward pressure brings a pin, head up, through the metal-ringed aperture in the top.

The Fay bridge pad of Bakelite laminated material, in a mottled color effect of green, rose, and gold, forms an attractive bridge table accessory.

Economy in molding, as well as harmony in finish, is achieved by the use of a single mold to produce both nut and fruit bowls, similar in general design, yet different in detail.

In keeping with the precision products of an engineering firm, sample cases of highly polished black Bakelite molded material are used for Hoffmann balls and rollers. A single mold is used to produce both top and bottom of the case, and the press button fastener is inserted at time of molding.

# NEWS of the INDUSTRY

### Bakelite Construction News

THE Bakelite Corporation is erecting an additional, three-story building of steel, concrete, and brick at Bloomfield, New Jersey, to house research and development in Bakelite air-drying varnishes, laminated structural materials, and Halowax. The building will have a floor area of 22,500 square feet, which will add one-third to the present facilities. Since its formation, the Bakelite Corporation has utilized, for research and development, its Bloomfield plant, which was formerly the manufacturing unit of the Condensite Company of America. Plans are also being made for the construction of a factory in Bound Brook, New Jersey, where a 100-acre tract of land was recently purchased.

### Monsanto Wins Selden Suit on Phthalic Anhydride Process

THE United States District Court in St. Louis, in a decision dated March 4, 1930, declared the Selden Company's patent 1,647,317, entitled "Process of carrying on Catalytic Conversions", invalid.

Pertinent excerpts from the Court's opinion are as follows:

"* * * it is quite difficult to see that there is anything bordering on invention exhibited in the patent in suit."

"The process of the patent is thus shown to have been in common commercial use, and exemplified in many patents in the same and analogous arts."

"In our judgment the patent is so clearly lacking in invention that there is no occasion to consider other matters presented."

The Selden Company filed the suit against Monsanto in November 1927, alleging that the latter company's Phthalic Anhydride process infringed.

### NEMA MEETING

THE next meeting of the Molded Insulation Section of NEMA will be held again at the Hotel Statler, Buffalo, on Tuesday, April 1st, at 10 o'clock. The program will be as follows:

1. Roll Call.
2. Approval of minutes of meeting of February 18th, 1930.
3. Group Buying—
   Report of Mr. Stone's Committee.
4. Uniform Credit
   (a) Result of letter ballot.
   (b) Acceptance form.
5. Generic Name Prize Fund Balance.
6. Cost Accounting—
   Report from Mr. Quigley.
7. Trade Extension—
   Report of Mr. Rossiter's Committee.
8. F.T.C. Report on Trade Practice Rules.
9. Water Marks.
10. New Business.
11. Date of Next Meeting.
12. Adjournment.

### Farrel-Birmingham Elects New Officers

AT the annual meeting of Farrel-Birmingham Company, Inc. held at the general offices in Ansonia, Connecticut, on February 20th, Franklin Farrel, Jr., who was formerly Vice President, became Chairman of the Board and N. W. Pickering was elected President to succeed Walter Perry.

D. R. Bowen, Chief Engineer, Carl Hitchcock, formerly Assistant Secretary, Franklin R. Hoadley, Manager of the Foundry Department and A. G. Kessler, Manager of Buffalo Division were elected Vice Presidents.

Officers re-elected were Alton Farrel, Treasurer; G. C. Bryant, Secretary; F. M. Drew, Jr., and L. K. Blackman, Assistant Treasurers; and W. B. Marvin, Assistant Secretary.

### New Catalin Plant

THE American Catalin Corporation announces that its new plant under construction at Perth Amboy, N. J., will be ready for production of its plastic material about May 15th. The present College Point plant will continue production until the new plant is tuned up to meet all demands, after which it will be abandoned. The new plant will have considerably enlarged facilities over the old plant.

### New Molders in Southern California

THE Golden State Rubber Mills, (formerly Long-Turney Corp.), which for the past eight years has specialized in molded rubber goods for unusually severe service, has recently entered the resinoid plastics field, molding Bakelite and Aldur, particularly for the petroleum and motion picture industries where several interesting uses have developed.

Both rubber compounding and plastic molding are under the supervision of R. B. Stringfield, who is a graduate Chemical Engineer from the Massachusetts Institute of Technology, and was formerly Chief Chemist of the Goodyear Tire and Rubber Co., of Calif.

The plant is located at 1920 E. Vernon Ave., Los Angeles, California.

### Quigley Speaks

LEON V. QUIGLEY, Technical Editor, Bakelite Corporation, addressed the February meeting of the North Shore Men's Club, Long Island, on "Chemistry in the Nation's Business". On March 7th, in the Fireside Series of Sunday night meetings of the Town Hall Club, Mr. Quigley spoke on "Chemistry in the Complex Present — The Relation of Science to Everyday Interest".

### Jewell Hot Molding Pyrometer

THE new Jewell hot molding pyrometer, Pattern No. 80, has been designed to give rapid and accurate temperature readings to all portions of a mold, either of the hand operated or automatic type. It consists of a d'Arsonval movement in an insulated case with scale reading from 50°F to 400°F, in 5° divisions. The scale is 3½ inches long. It is manufactured by the Jewell Electrical Instrument Co. of Chicago, Ill.

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We are going to expose you to a quotation of George Eastman, chairman of the board of Eastman Kodak Company—who also make industrial chemicals:

"During the fifty years the Eastman Kodak Company has been in business there have been several times when, at the outset of one of these years, we faced what seemed an abnormally bad condition in general business.

"I am not at all sure there is a depression facing us; but to be on the safe side, the Eastman Kodak Company is taking the same attitude that it did in 1908 and 1914.

"And just as advertising has played such a vital part in the expansion of the business of the Eastman Kodak Company, so we believe it to be a most powerful force in the building of our great American industries; in the wide diffusion and maintenance of our national prosperity."

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### Molded Printing Plates

(*Continued from page 231*)

be sold at a cost of one cent per square inch, with a minimum charge of thirty cents for the plate, which is less than one-

half the charges for the competing electrotype. And withal they can be sold at this figure at a profit that makes stock in the company a highly desirable investment. Unfortunately, no shares are being offered for sale. The company is apparently soundly financed and hopes to continue production of Flexo Plates on a grander scale than ever before and introduce a new era in the printing industry in which a plastic composition will be the basis for a revolutionary transformation.

## Millions of Salesmen

(*Continued from page 223*)

fic messages would be printed and distributed.

Fourth:—The cost of this dominant advertising and marketing campaign would be about $20. per week for contributing members. These contributing members would be composed of

1. Plastic material producers
2. Molding machinery manufacturers
3. Custom molders
4. Private molders
5. Suppliers of materials to molders who would benefit by increased business.

These five classes would each furnish their proportion of the fund. Each member of a group would contribute in proportion to his volume. As there are approximately 1,000 firms in the five classes we would have an average contribution of $1,000. per year.

And as every advertisement would be of benefit to every member it would mean two hundred million sales messages, each doing a salesman's job in increasing volume—yet costing only one cent for every two thousand calls.

## British Industries Fair

(*Continued from page 228*)

the blind now make. Many of them compete in the open market. A number of Erinoid napkin rings and other novelties were perfectly made productions. The blind workers do all their work in central London.

At the London section of the Fair it was molded products rather than molding materials that were featured, while at Birmingham there was a comprehensive array of molders' equipment, especially molding presses. Both sections were highly successful, and a committee is now considering the future development of the Fair. So successful has it been of recent years that this committee is investigating the desirability of holding a second fair in the fall and the possibility of organizing a travelling fair either in ships or trains. It will also consider the possibility of holding the fair, or sections of it, at important centers abroad. Next year, however, when Olympia is completed, another 100,000 square feet will be available for the Fair. With 16 acres of floor space, Olympia will then, and for years to come, be able to accommodate the largest trade exposition London may reasonably look forward to.

## Resinoids and the Auto

(*Continued from page 225*)

By this time the art of making phenol resinoid canvas laminated had been developed to a point where it offered the very characteristics the manufacturer required. Today the front end drives of two-thirds of the cars produced in this country are silenced with phenol resinoid gears.

The standard equipment of the present automobile, unlike that of a few years ago, includes a number of resinoid molded items of utility and embellishment such as shift lever balls, control knobs, switch bases,

dome light frames, vanity cases, cigar lighters, etc., made in various colors to conform to the color scheme of the car. As phenol resinoid laminated materials can be made to bear faithful likeness to the grain of the finest woods, it is not unreasonable to expect that before long the owner may insist that instrument boards, garnish molding, and even the body of the car be made from these phenol resinoid products, which though they simulate wood are far more serviceable under the conditions to which a motor car is subjected.

In the early days the noise from other parts of the vehicle was so great that, relatively speaking, the operation of the timing gears was quiet, but in spite of this some of the more progressive manufacturers saw an opportunity to eliminate some of the noise through the use of fiber or rawhide gears. It was soon found, however, that normal operating temperatures of the engine, crank case condensation, and grit accumulation in the lubricant made the use of such gears impracticable. Under such conditions they were subject to dimensional variation and had a short life, so that for the time being the motor car manufacturer made no further attempt to silence his timing train, and devoted his attention to other more noisy parts of the car.

#### Resinoids Keep Pace

Progress in the phenol resinoid industry has kept pace with that in the automotive industries. New materials are constantly being developed to meet new and more exacting needs.

A molding material of very high electrical resistivity, and high dielectric strength has been developed, whose striking characteristic is its greatly lowered tendency to carbonize under the electric arc. This material is finding an increasing use in the ignition systems of airplanes and bids fair to be adopted for ignition on other automotive vehicles. A similar molding material, because of in-

creased flexibility, appears to be solving the problems arising from the difference in expansion between a reinforcing metal core and its molded resinoid covering. An important use is found in the steering wheel.

Improvement in molding materials for commutators has made it possible to solder the armature leads by rolling the commutator through a bath of molten solder instead of by soldering each lead separately.

Improvement in canvas laminated gear blanks has been such as to increase the life of phenol resinoid laminated gears from about 15,000 miles to almost that of the car.

The improved character of these laminated materials has made them available for thrust washers in the rear axles of heavy trucks.

A fabric-filled molding material has been developed which has a very high resistance to impact.

### New Techniques

The composite method of molding a pure resinoid surface onto a standard molding material has made it possible to produce molded rings and horn buttons that have a much improved appearance through greater gloss and "depth" of surface.

An increasing amount of resinoids is entering into the composition of materials for impregnation of brake linings and clutch facings, with the advantages that arise from substituting fusible materials by the infusible resinoids.

As may be assumed from its increasing number of applications, the consumption of phenol resinoid materials by the automobile industry has grown even more rapidly than that industry itself. It is well within the possibilities, as suggested above, that automobile bodies of phenol resinoid impregnated fibrous materials may be developed which will be strong and rigid, and which will have the advantages of being lighter in weight and less resonant than the present metal bodies.

# Advertisers' Index

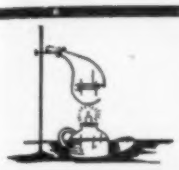






## Exports of United States Pyroxylin Products, By Countries
## December, 1929

| Countries | Sheets, rods, or tubes | | Manufactures | |
|---|---|---|---|---|
| | Pounds | Dollars | Pounds | Dollars |
| Austria | ...... | ...... | 192 | 67 |
| Denmark | 183 | 247 | 13 | 46 |
| France | 6,768 | 600 | ...... | ...... |
| Germany | 782 | 823 | 53 | 63 |
| Italy | 68,122 | 8,068 | 5 | 43 |
| Netherlands | ...... | ...... | 12 | 126 |
| Sweden | ...... | ...... | 64 | 419 |
| Switzerland | ...... | ...... | 42 | 273 |
| United Kingdom | 260,895 | 51,904 | 146 | 755 |
| Canada | 203,432 | 152,450 | 21,051 | 34,102 |
| British Honduras | ...... | ...... | 3 | 3 |
| Guatemala | ...... | ...... | 386 | 1,443 |
| Honduras | ...... | ...... | 60 | 183 |
| Nicaragua | ...... | ...... | 15 | 93 |
| Panama | 53 | 57 | 522 | 812 |
| Salvador | ...... | ...... | 112 | 748 |
| Mexico | 247 | 241 | 3,088 | 7,054 |
| Newfoundland and Labrador | 30 | 30 | 20 | 57 |
| Other British West Indies | ...... | ...... | 23 | 12 |
| Cuba | 73 | 110 | 2,186 | 6,382 |
| Dominican Republic | ...... | ...... | 105 | 178 |
| Haiti, Republic of | 30 | 30 | 11 | 45 |
| Argentina | 486 | 48 | 1,635 | 574 |
| Bolivia | 176 | 196 | ...... | ...... |
| Brazil | ...... | ...... | 234 | 260 |
| Chile | 164 | 200 | 48 | 89 |
| Colombia | 111 | 201 | 2,132 | 1,915 |
| British Guiana | 35 | 38 | ...... | ...... |
| Peru | 154 | 138 | 20 | 40 |
| Uruguay | ...... | ...... | 48 | 34 |
| Venezuela | 34 | 31 | 175 | 608 |
| British India | ...... | ...... | 50 | 60 |
| Ceylon | ...... | ...... | 42 | 22 |
| Japan | 2,265 | 3,005 | ...... | ...... |
| Philippine Islands | ...... | ...... | 249 | 248 |
| Australia | 8,400 | 6,036 | 13,492 | 9,566 |
| New Zealand | 789 | 549 | 300 | 221 |
| Union of South Africa | ...... | ...... | 468 | 555 |
| Total | 553,229 | 225,002 | 46,966 | 67,096 |
| Shipments from U. S. to: | | | | |
| Hawaii | 770 | 841 | 1,051 | 1,626 |
| Porto Rico | 482 | 563 | 2,556 | 3,672 |



# Materials
## for the Plastics Industries



## BUYERS' GUIDE

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This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in PLASTICS. Please mention PLASTICS when writing to these firms.

# And Now, In Closing:

Impressions gathered in and about the molding industry in the past month . . . Tube base business still bad . . . what did we tell you? . . . Radio starting to pick up, but it's a long pull . . . ditto automotive . . . new proprietary articles are most popular . . . another consumer molder gives up in disgust . . . what about the others? . . . But yet another goes in for custom molding . . . Good Lord, forgive them! They know not. . . Too much misplaced optimism in the face of short term contracts . . . unemployment as bad as any industry, with the mighty dollar mightier than ever at about $1.25 . . . the Treasury (U. S.) says $1.04 . . . increased business on the west coast . . . that "about six good molders could handle all existing business" . . . pat yourself on the back, conditions are worse in Merrie Englande . . . English banker says "sell British stock; buy U. S. investments" . . . what a panic that would cause in any non-lethargic country! . . . in ours . . . apropos of that, "sell your molding plant and go in another business" . . . good advice to some, at that . . . something like spitting up a well (at a Cremo) . . . the self-made executive is often stubborn with his wallet . . . or without it . . . business 40% under normal; 12% over December . . . according to reports, molders were the only ones to lose money in Wall Street . . . watch the urea materials . . .

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Concerning generic names, the Editor's correction further back in the book in reference to the Coty Tray makes it a reducto ad absurdum. Coty speaks of all resins as Bakelite, even though the original order specified Coltrock. Durez, however, is used entirely in this article. Our thought for the month is, "how generic is Bakelite?" No one can do anything but envy the public position of this material, even after a near error such as our own.

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The long awaited article on plastics (the one we spoke about in the last two issues) reached the desk three days after our March issue went to press. Those interested can find it, barring accidents, on page 82 of the February "Fortune". This publication can be had by the way, for $10.00 a year, which, we believe, hardly covers the cost of mailing. The correct and essential bits in the article can be laid at our door; the misinformation, if any, at "Time's," its publishers. One quotation: "the industry already has its own magazine, Plastics, full of strange pictures and stranger products." So, after five years, we are still exclusive.

> ### *And Then, In May:*
>
> We are indeed pleased to present to our readers an original article on an important, tho' sometimes overlooked, aspect of the industry. R. A. Worley has undertaken a paper on synthetic resin grinding-wheels. Mr. Worley is chief chemist with the Precision Grinding Wheel Company, of Philadelphia, and is exceptionally well qualified to speak on the subject.

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We hope that this year doesn't bring another price cut from some of the powder people. Fortunately, some of those who have done some of this in the past have since ceased their manufacture. At the present time, to be explicit, not one molder would profit by a sudden price drop. He would either cut his own prices accordingly or be forced to it by his competitors and customers. If prices are ever changed they should act as a stabilizer, not degenerator, and should be done without any unfavorable publicity.

Publishing elsewhere, as we do, a picture of Queen Mary making a purchase, it behooves us to quote from our humorbible, the New Yorker, in regard to the recent British Industries Fair. It is taken from one of their recent "London Letters:"

"The lack of amusing novelty may be pardoned as an English characteristic, but the lack of taste is alarming. Here are all the things which have made England what it is. Here are the leather writing-cases with gilded daisies, the misshapen wicker furniture of the seaside boarding house, the green bowls 'crying for their aspidistra,' as Harold Nicholson has it, the horrible little red wooden things that hold knitting needles, all the hundred and one abominations with which the small country shop clutters its space, even to the nickel-plated framed photograph of Gladys Cooper 'as purchased by the Queen.' So the notice says."

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The first article by Benn C. Budd that appeared in our March issue was one that evoked considerable comment. We are sure that the plan he presents so logically in this month's Molded Products will be of even greater interest. Mr. Budd, we believe, would be only too glad to observe your own reactions and has consented to follow his plan up with any individual in the industry. Letters may be addressed to him at this office.

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We call attention to the page opposite. It is impossible to gauge the value of such service to the industry. It means a definite step toward joining plastics with the chemical industries, which is where they belong—not, as some think, in surgery. Look up last year's edition now, and be sure your listings are correct.